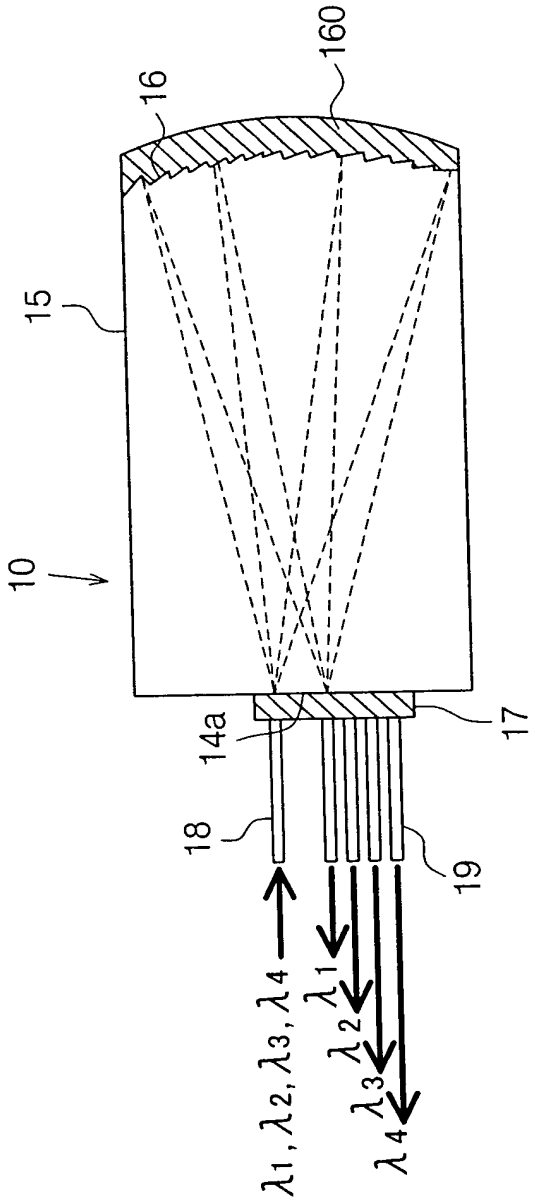
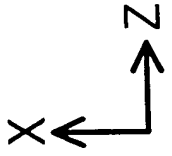


Fig.1



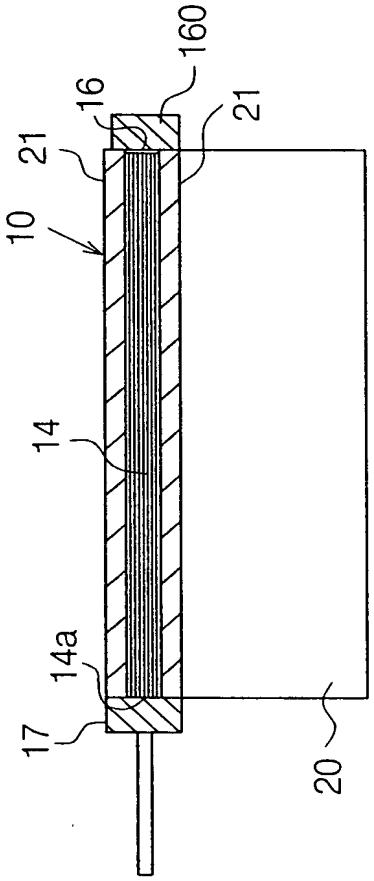


Fig.2

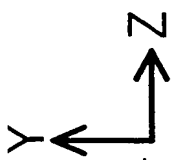
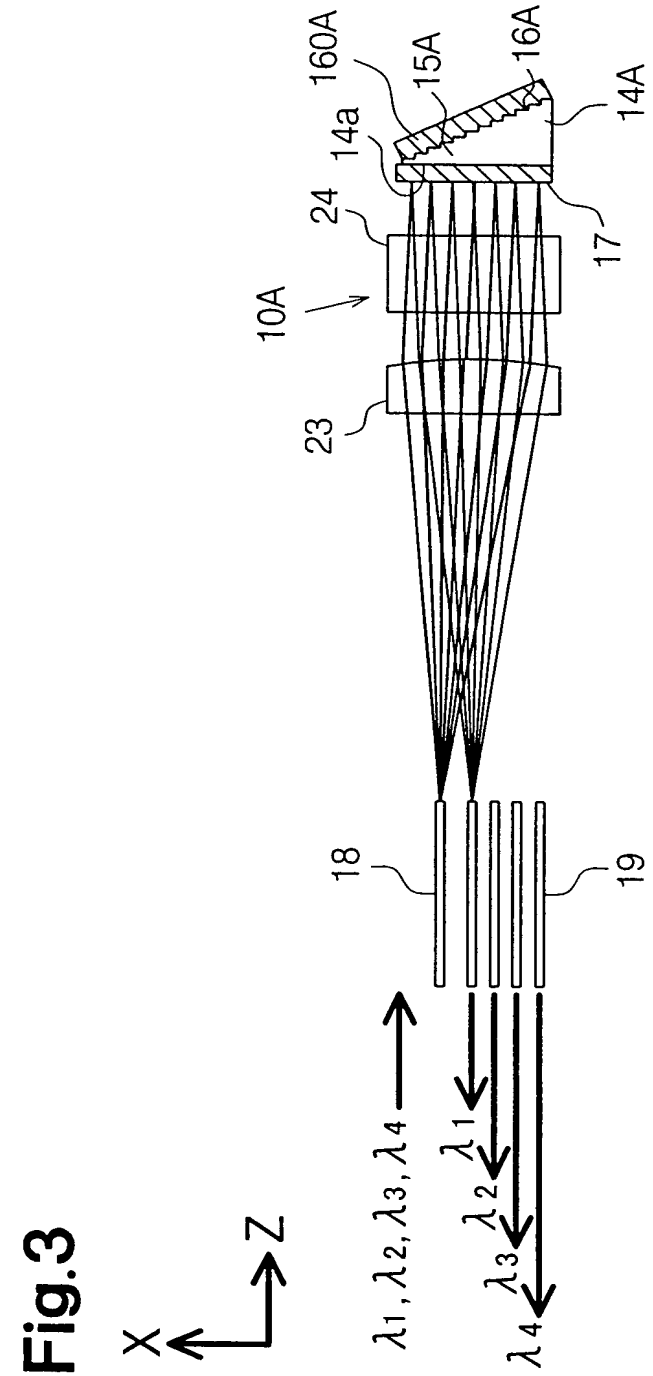


Fig.3



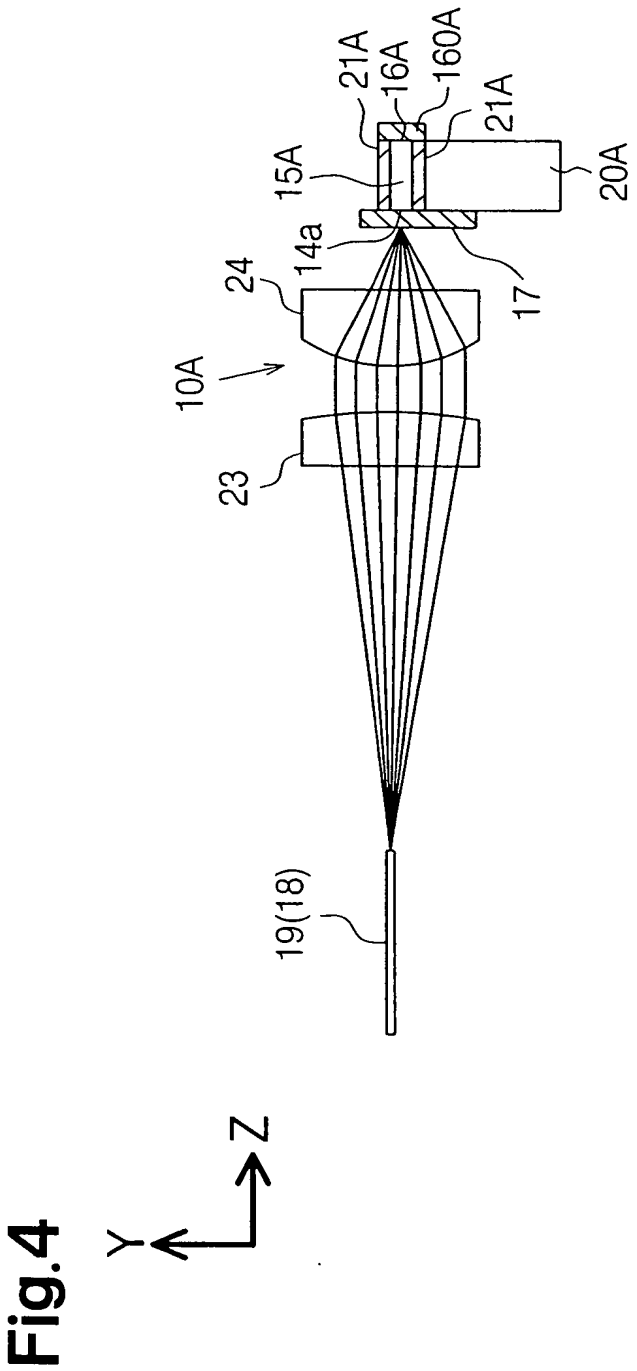
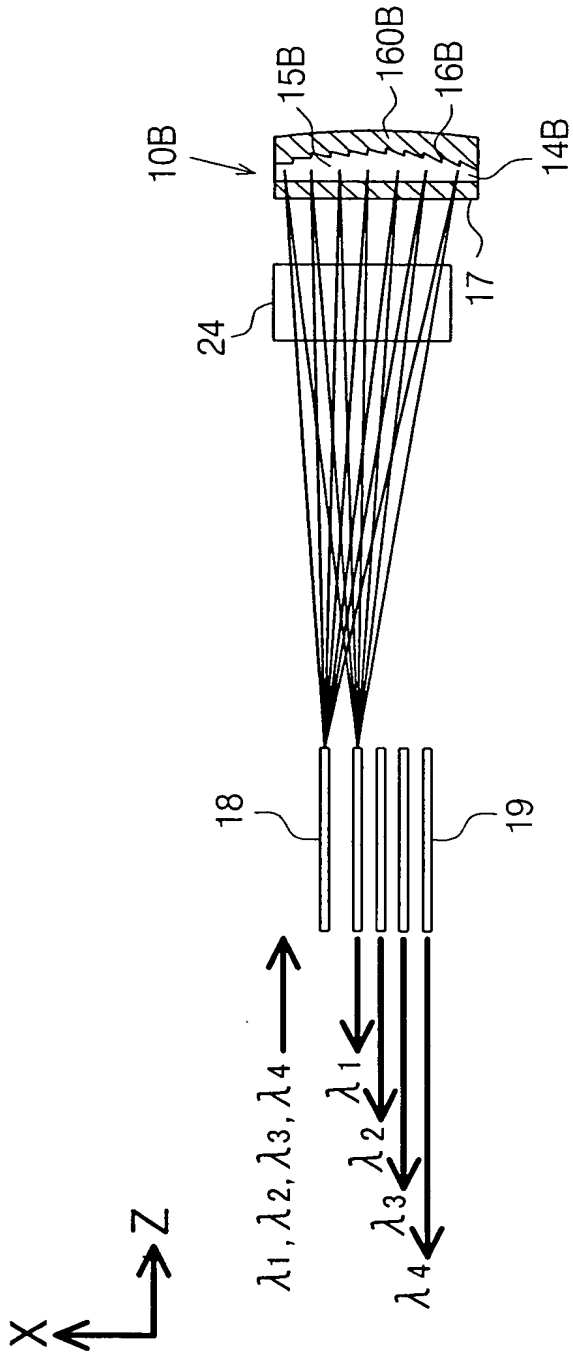


Fig.4

Fig.5



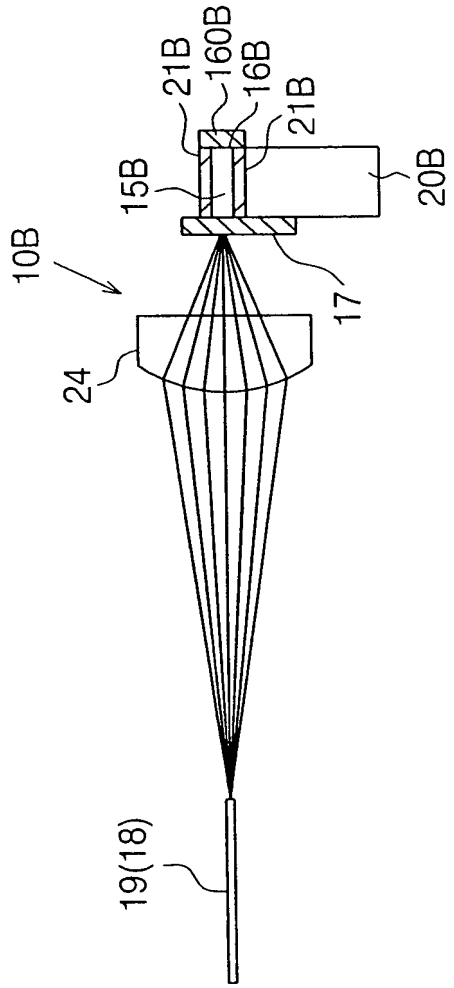


Fig.6

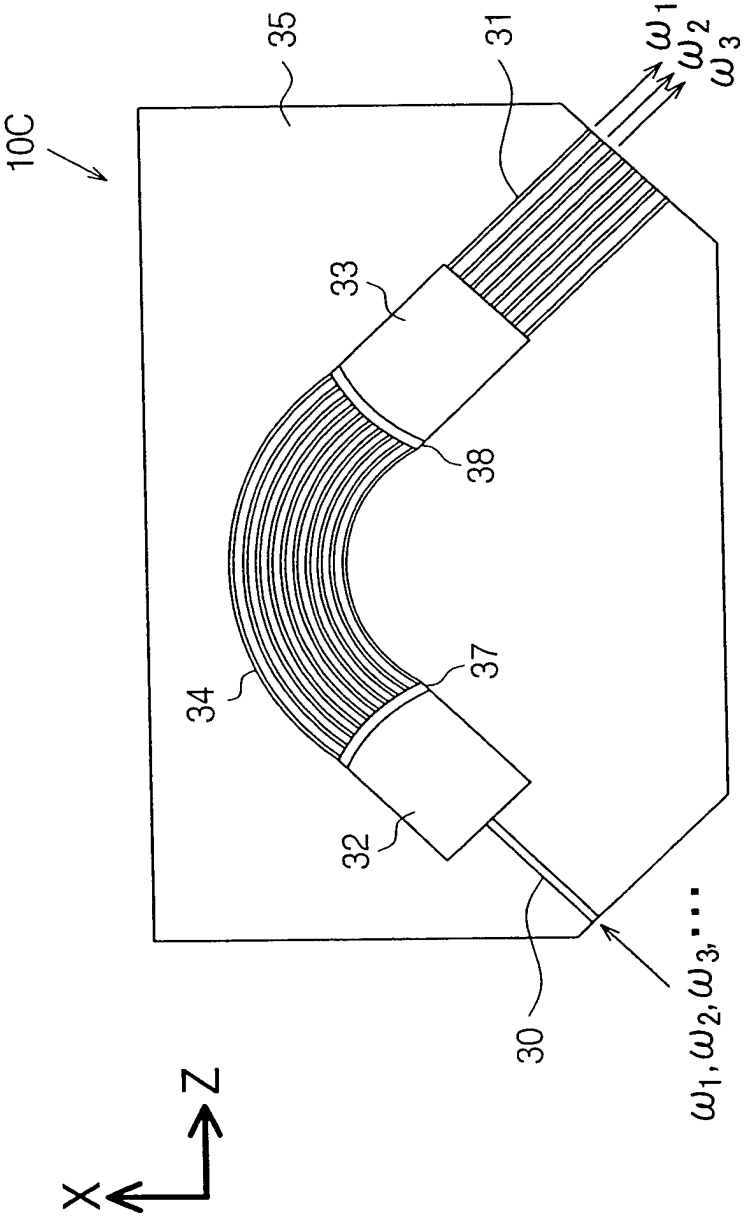
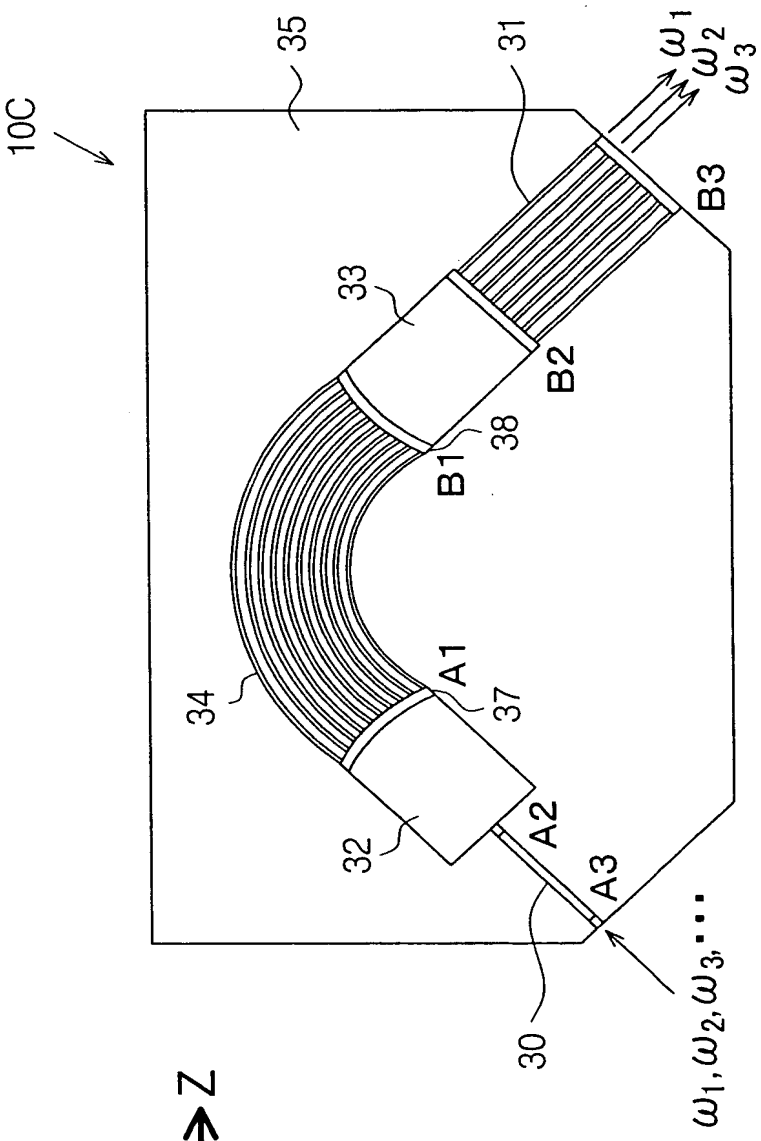

10C
35
31
ω_1
ω_2
ω_3
33
38
34
37
32
30
$\omega_1, \omega_2, \omega_3, \cdots$
X
Z

Fig.7

Fig.8


10C
35
31
ω_1
ω_2
ω_3
B3
33
B2
38
B1
A1
37
34
32
A2
A3
30
$\omega_1, \omega_2, \omega_3, \cdots$
X
Z

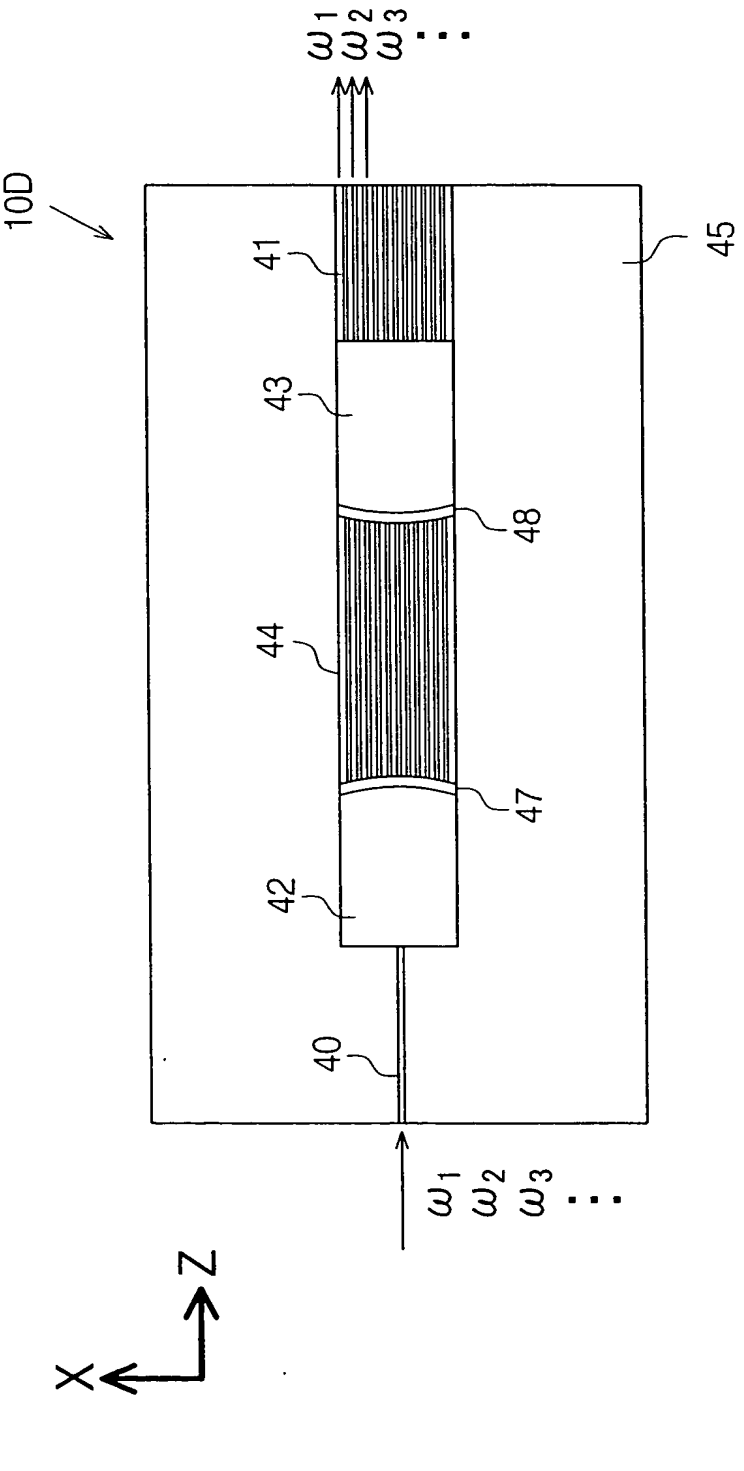


Fig.9

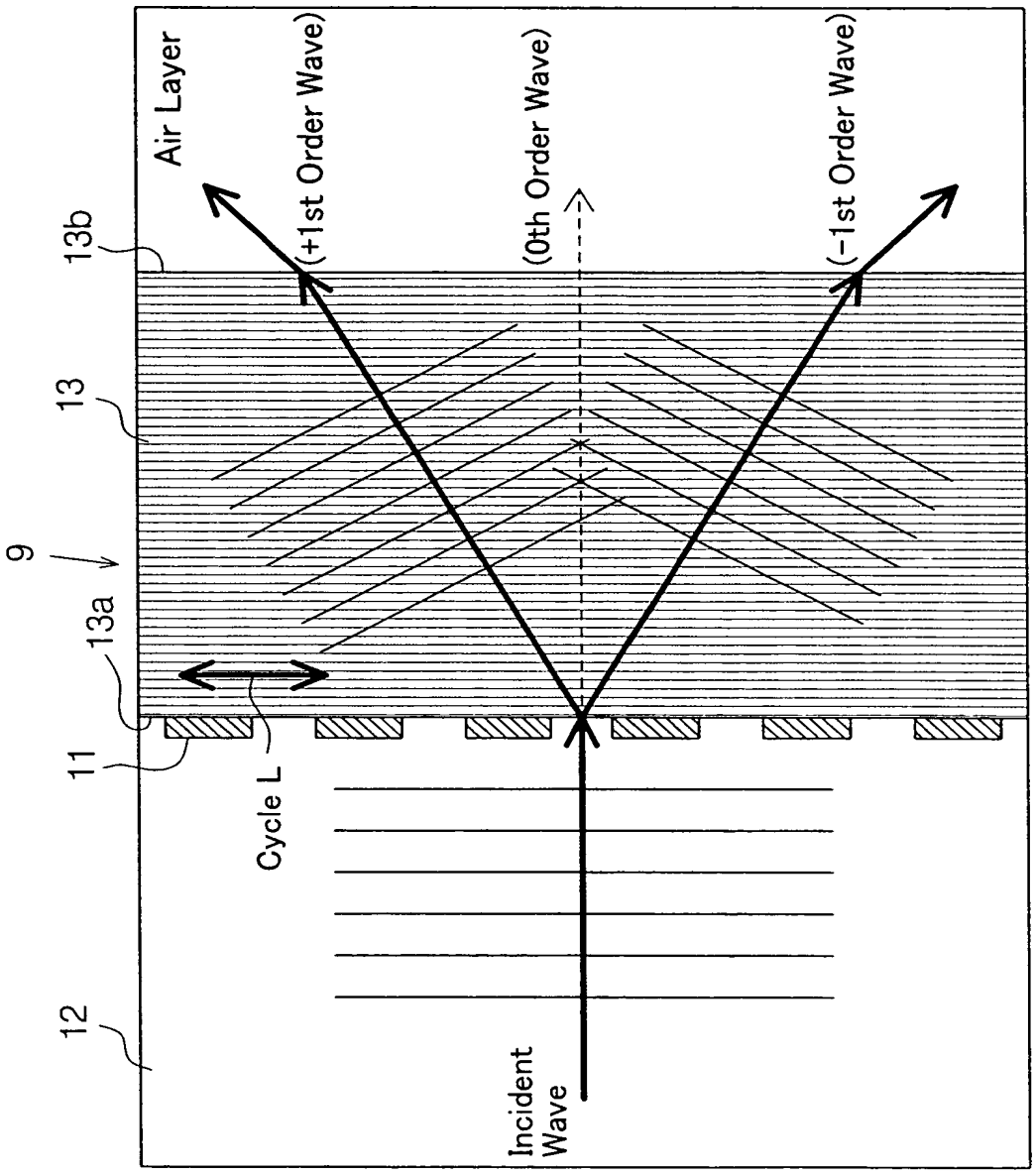
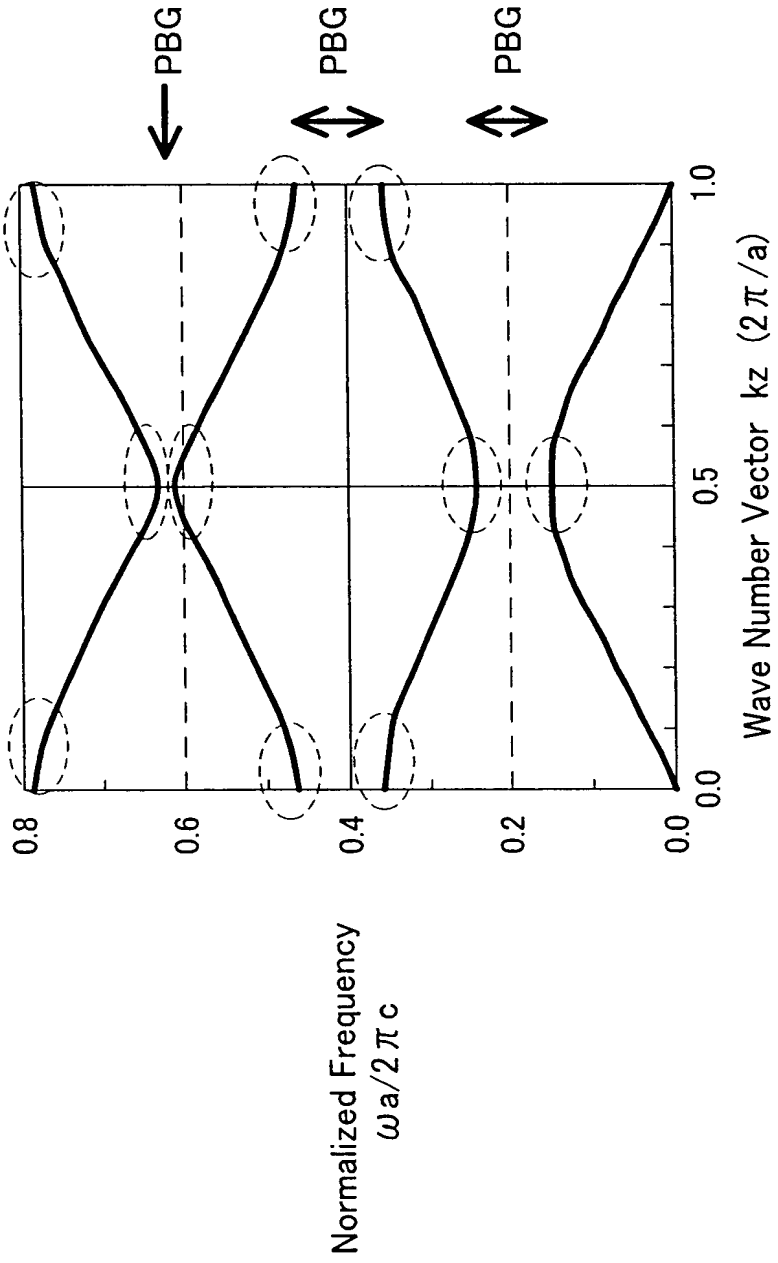

Air Layer
(+1st Order Wave)
(0th Order Wave)
(−1st Order Wave)
13b
13
9
13a
11
Cycle L
12
Incident Wave
X
Z

Fig.10

Fig.11


PBG
PBG
PBG
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
Normalized Frequency
ωa/2πc
Wave Number Vector kz (2π/a)

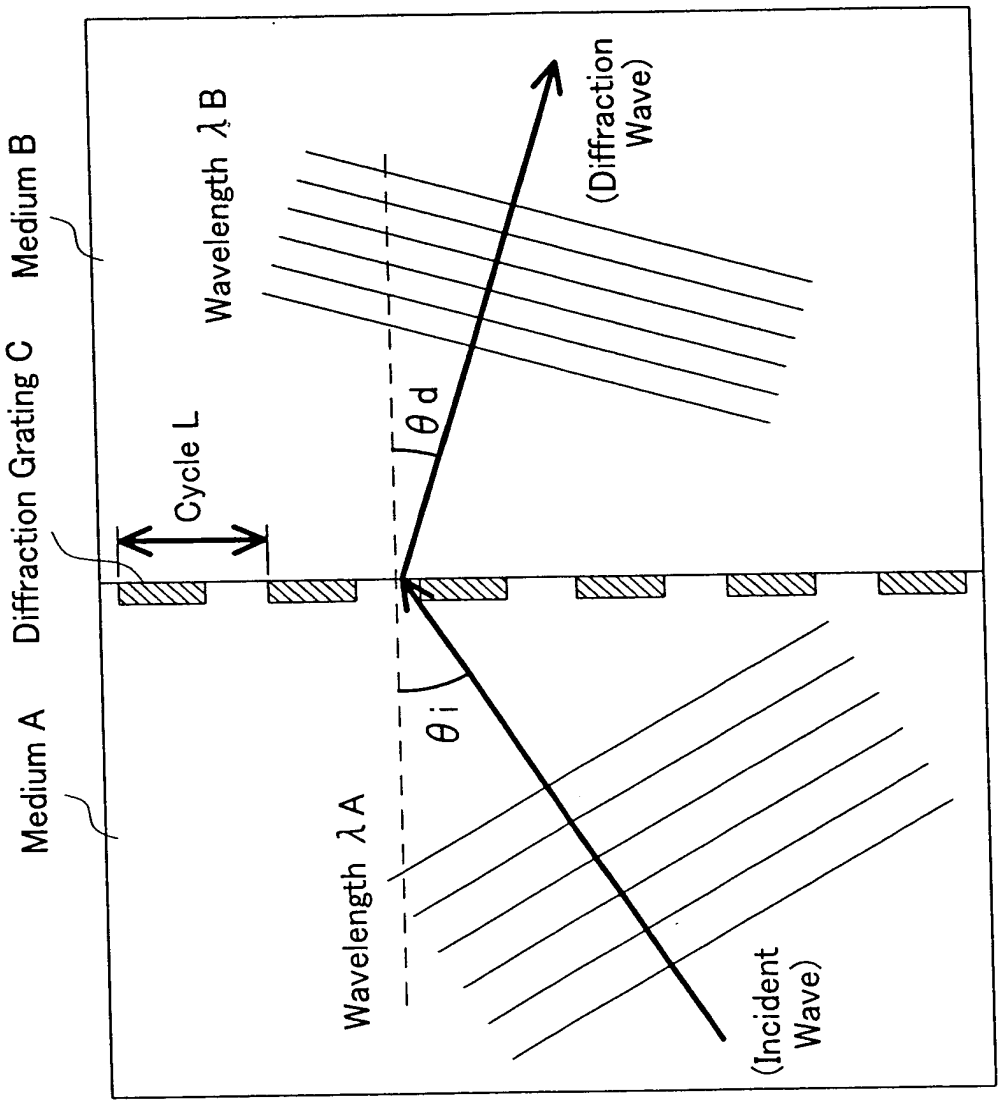

Medium B
Diffraction Grating C
Medium A
Cycle L
Wavelength λB
Wavelength λA
θd
θi
(Diffraction Wave)
(Incident Wave)

Fig.12

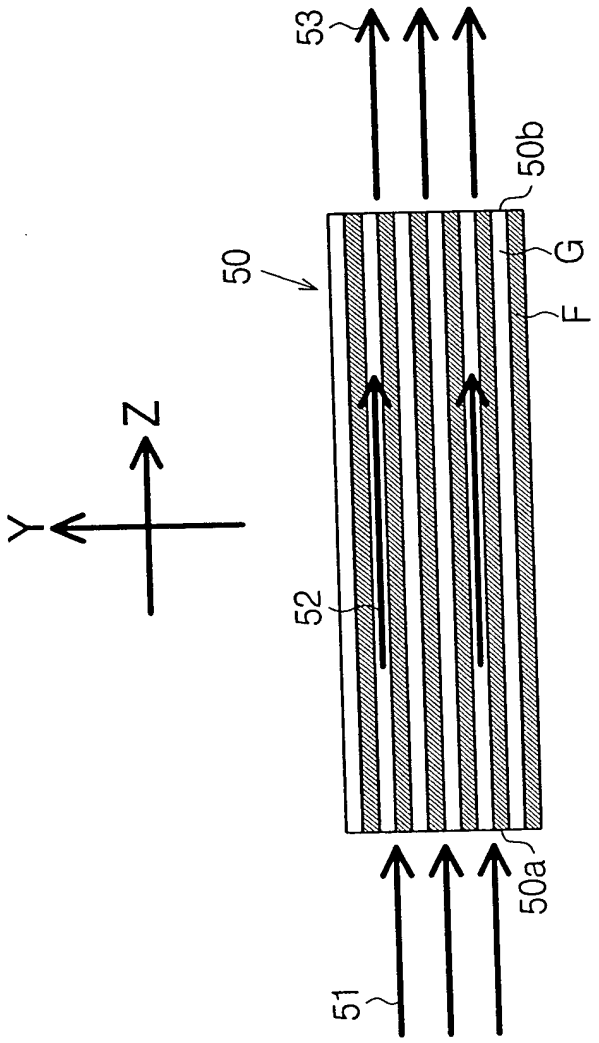


Fig.13

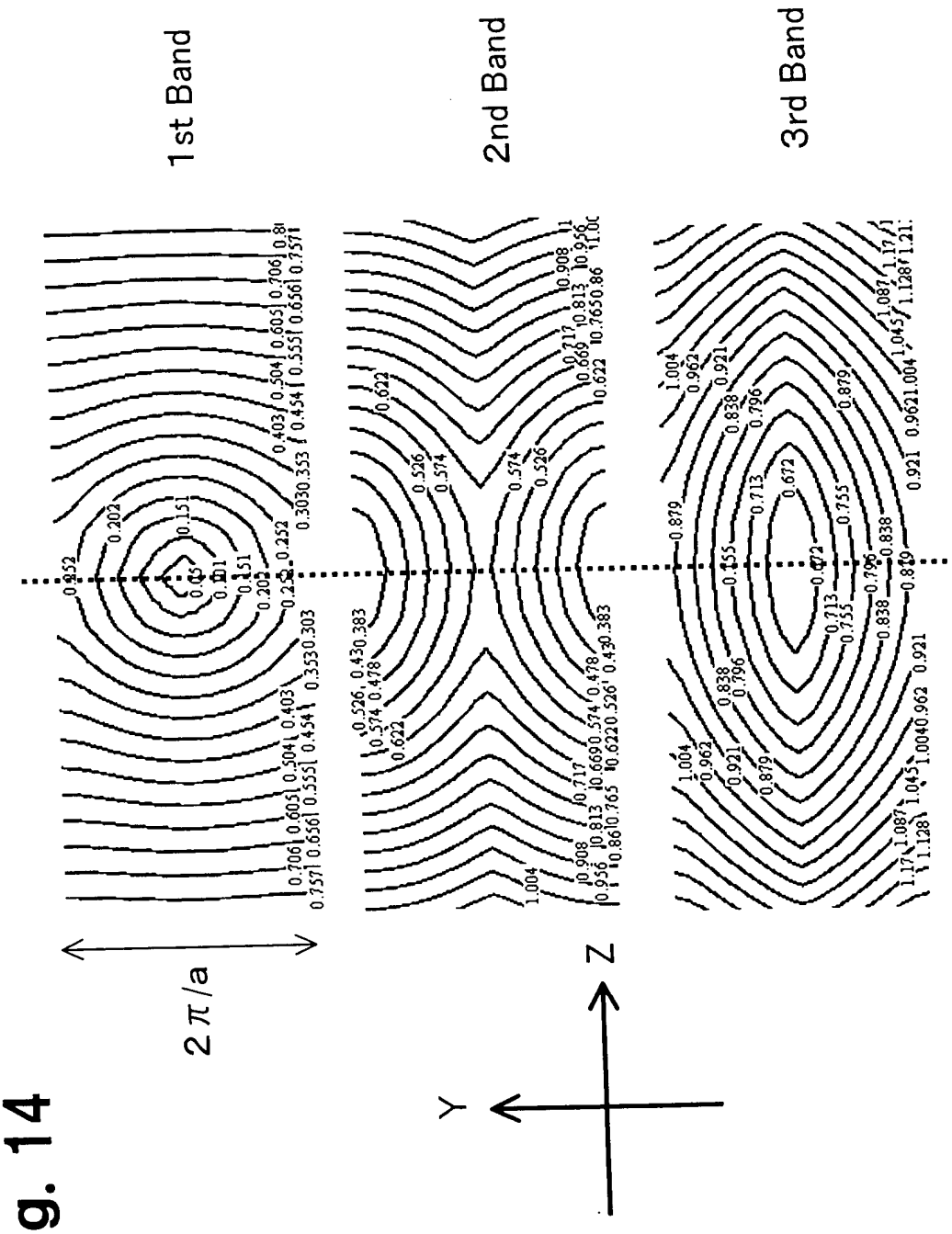


Fig. 14

Fig. 15

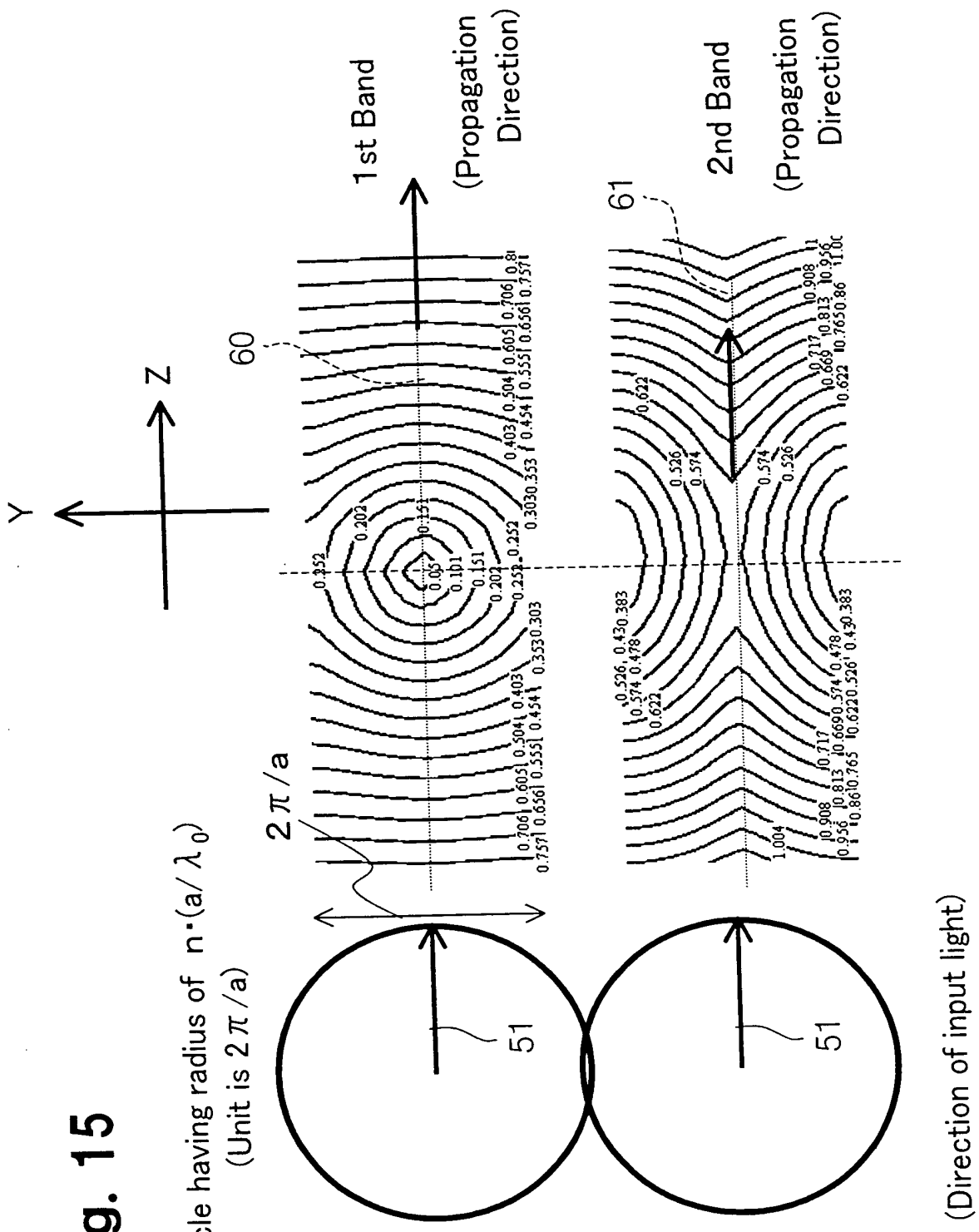

Circle having radius of n·(a/λ0)
(Unit is 2π/a)
2π/a
Y
Z
60
61
1st Band
(Propagation Direction)
2nd Band
(Propagation Direction)
51
51
(Direction of input light)

Fig.16

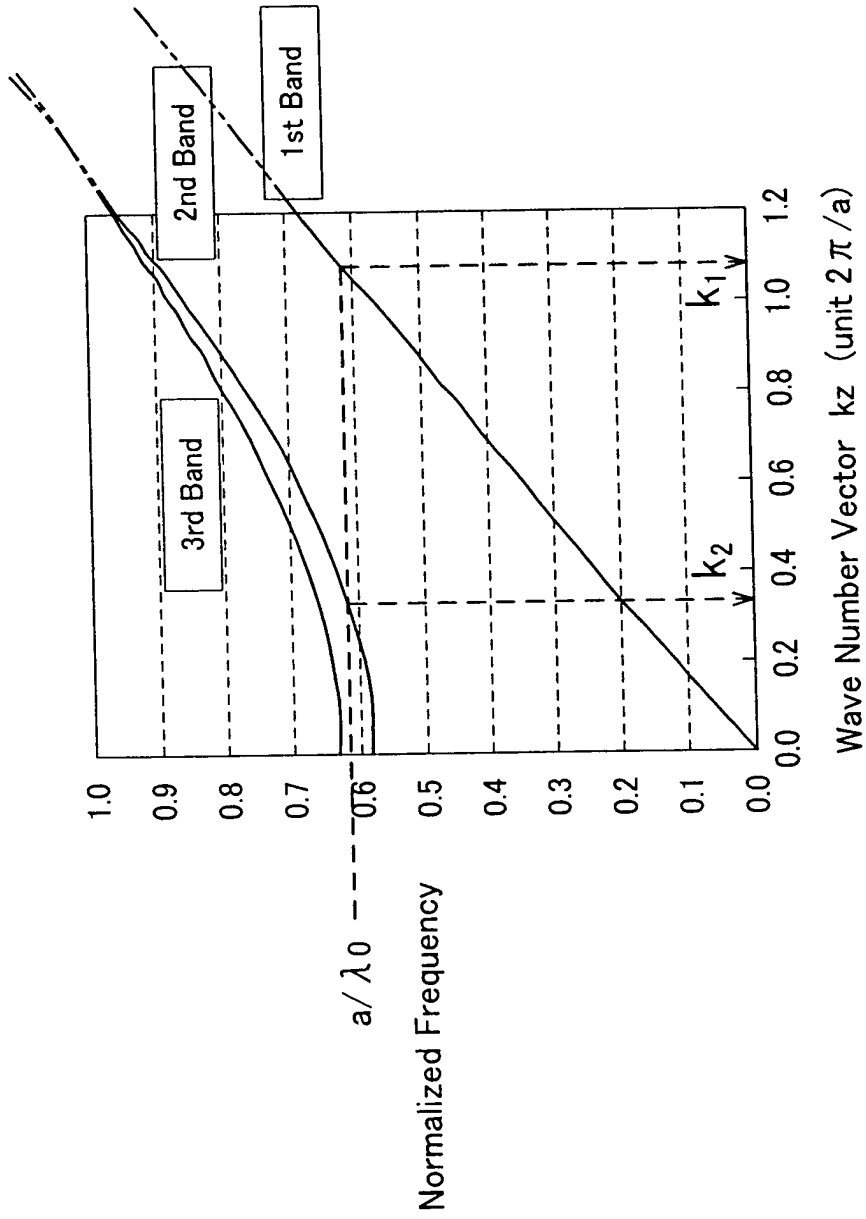

1st Band
2nd Band
3rd Band
k_1
k_2
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
a/λ_0
Normalized Frequency
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Wave Number Vector kz (unit $2\pi/a$)

Fig. 17

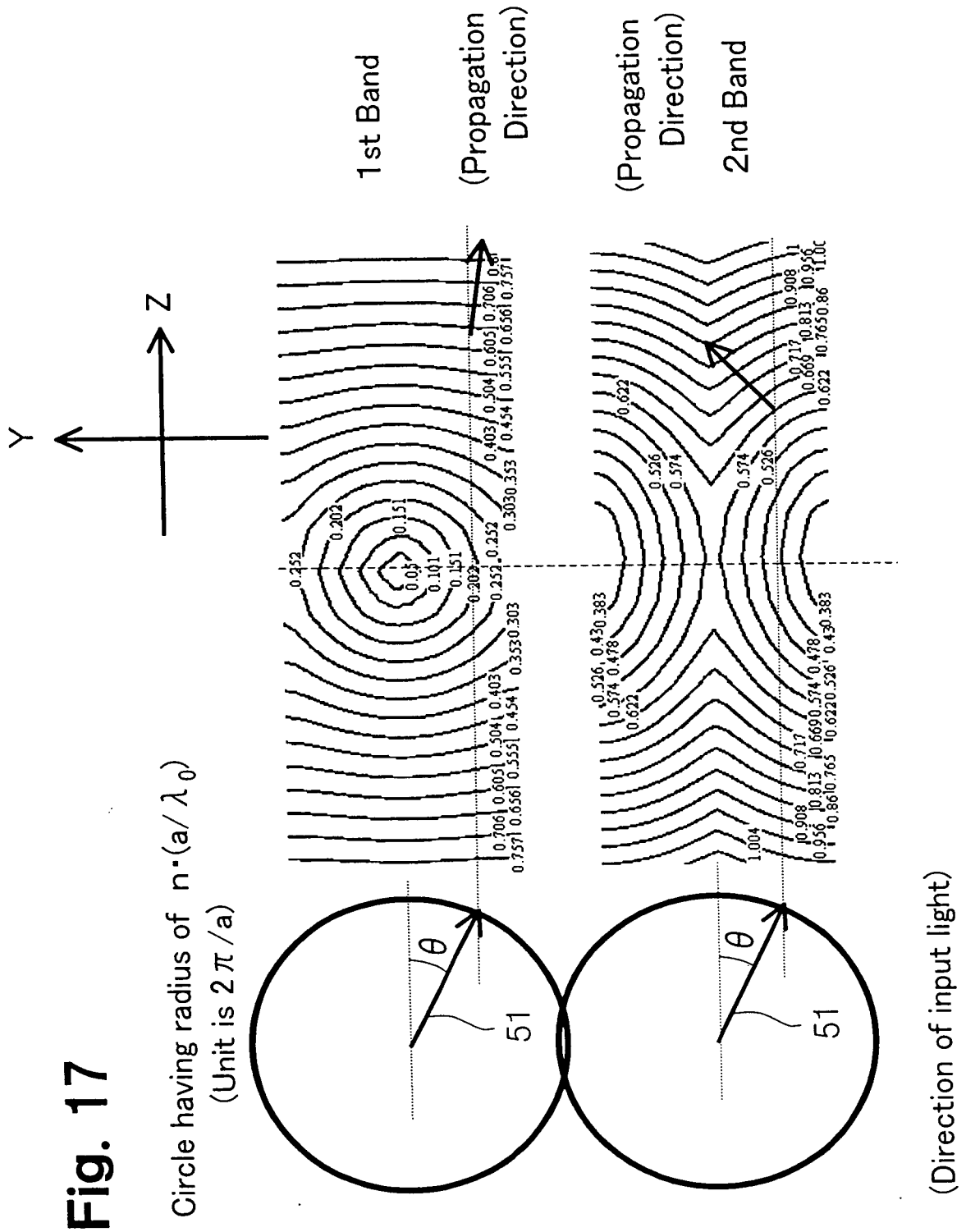

Circle having radius of n·(a/λ0)
(Unit is 2π/a)
Y
Z
1st Band
(Propagation Direction)
2nd Band
(Propagation Direction)
θ
51
θ
51
(Direction of input light)

Fig. 18

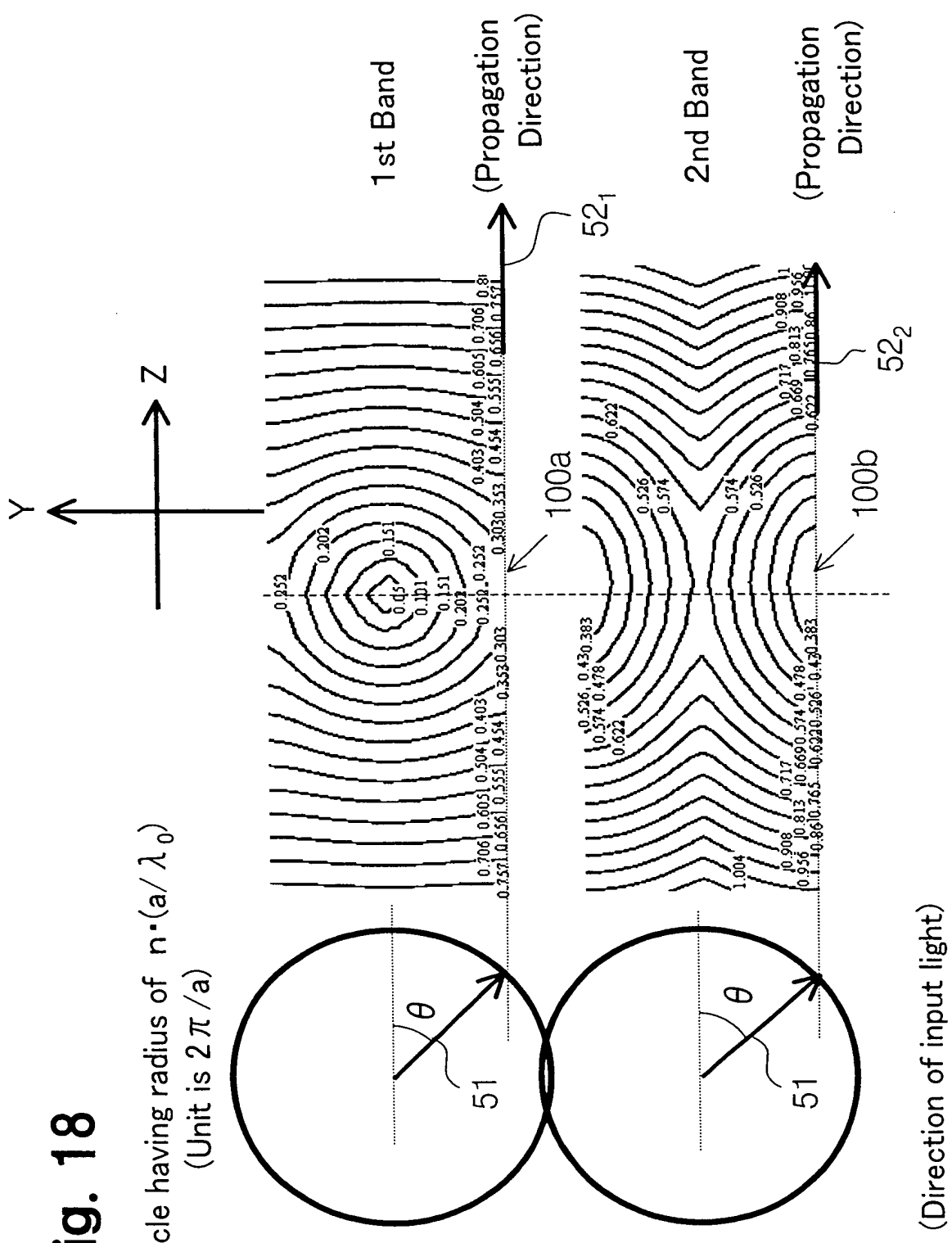
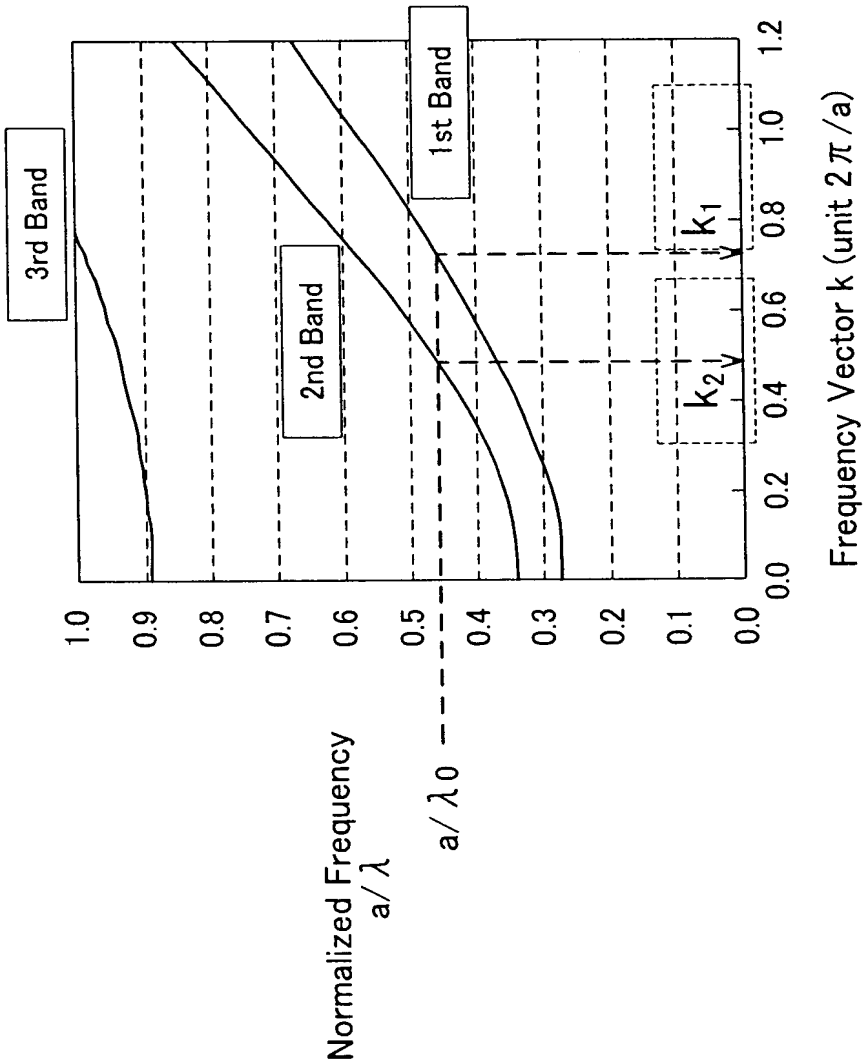

Circle having radius of n·(a/λ0)
(Unit is 2π/a)
Y
Z
1st Band
(Propagation Direction)
2nd Band
(Propagation Direction)
52₁
52₂
100a
100b
θ
51
θ
51
(Direction of input light)

Fig.19


3rd Band
2nd Band
1st Band
k_1
k_2
Normalized Frequency
a/ λ
a/ λ0
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Frequency Vector k (unit 2π /a)

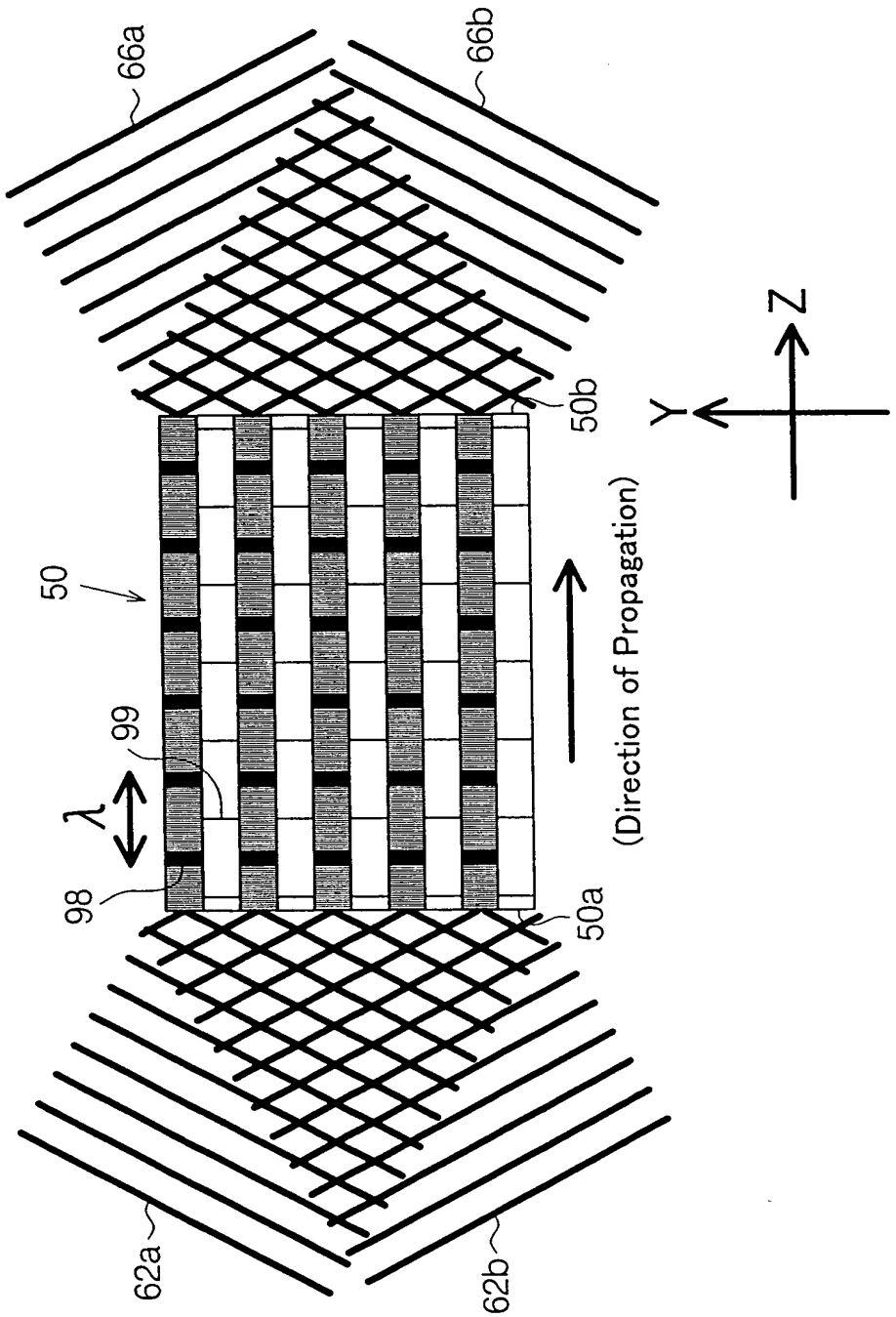


Fig.20

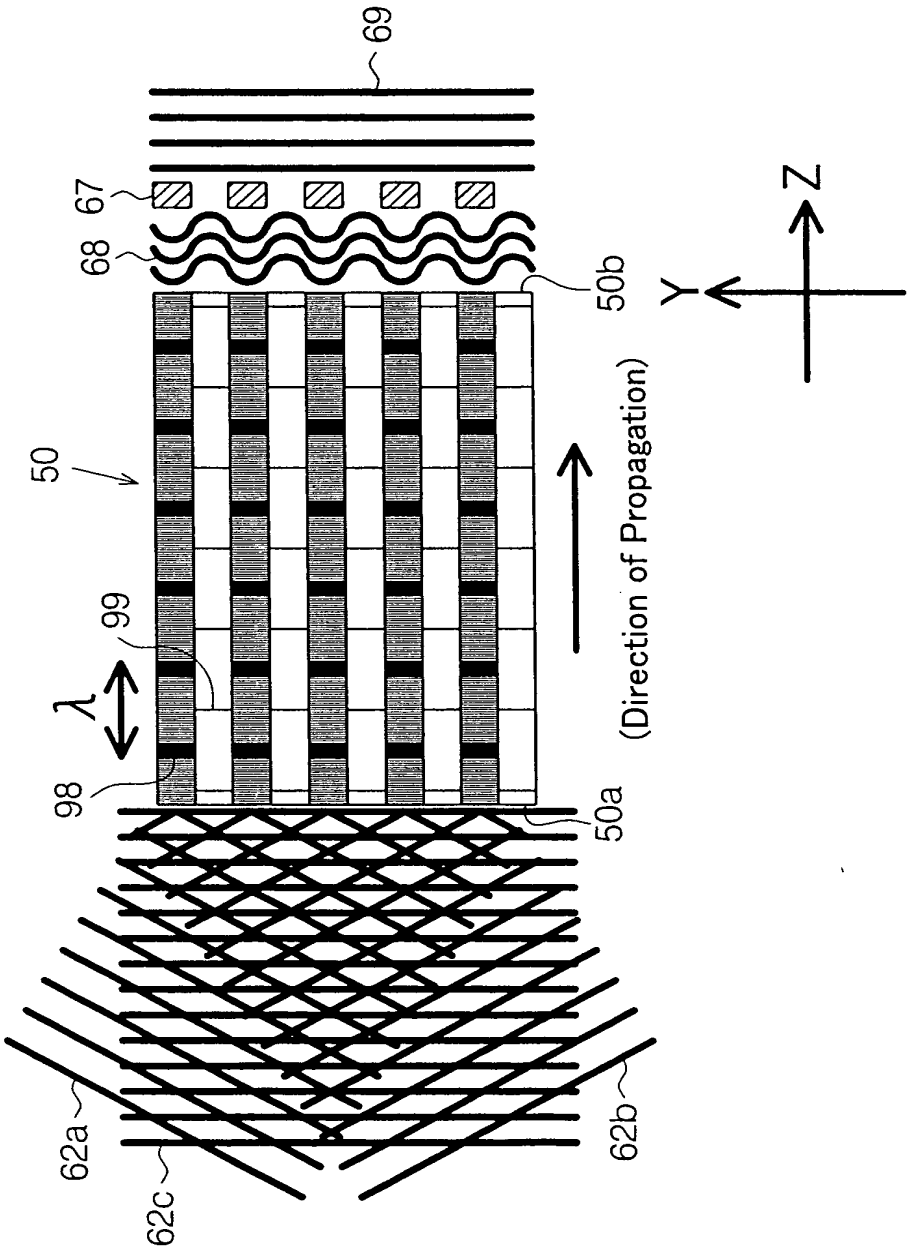

69
67
68
50b
Y
Z
50
99
λ
98
50a
(Direction of Propagation)
62a
62c
62b

Fig.21

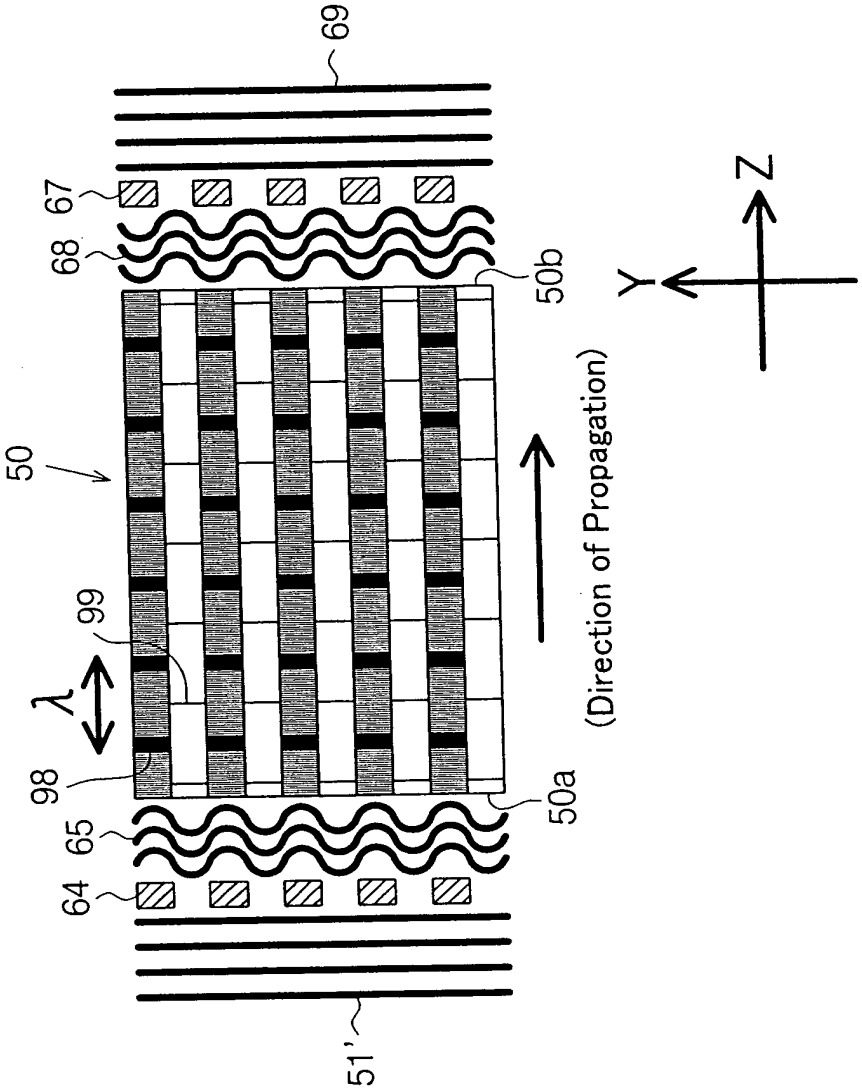
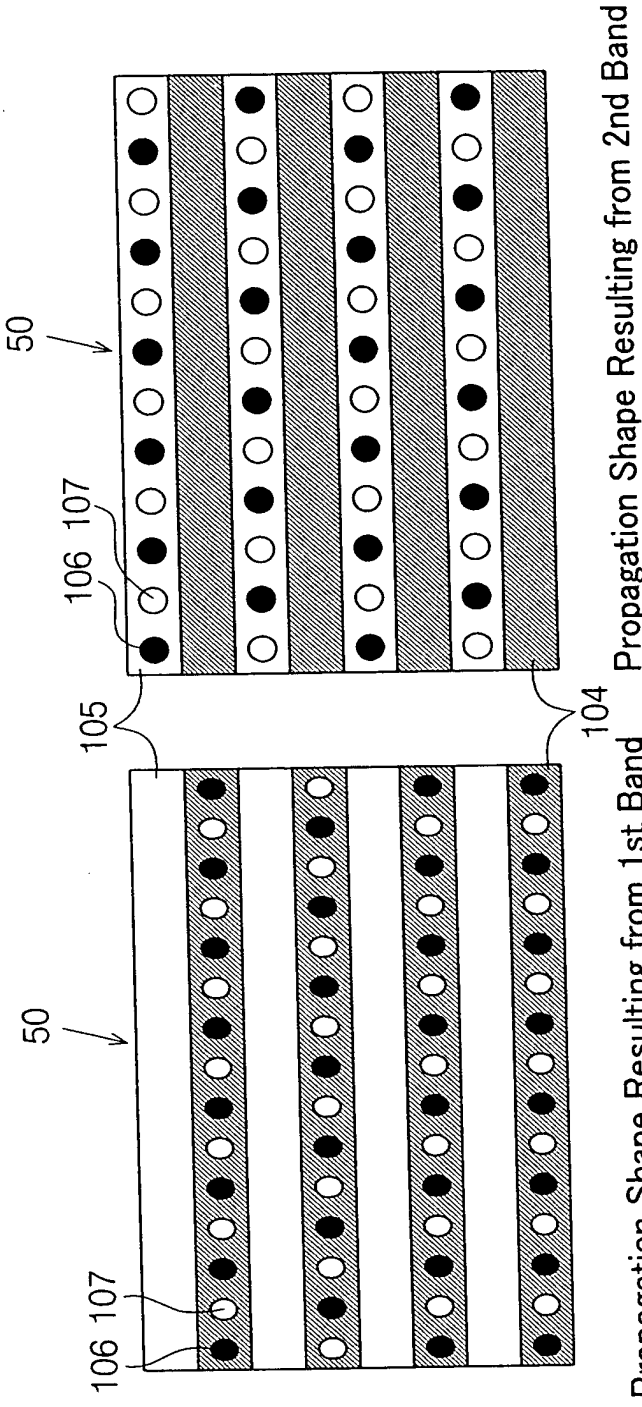
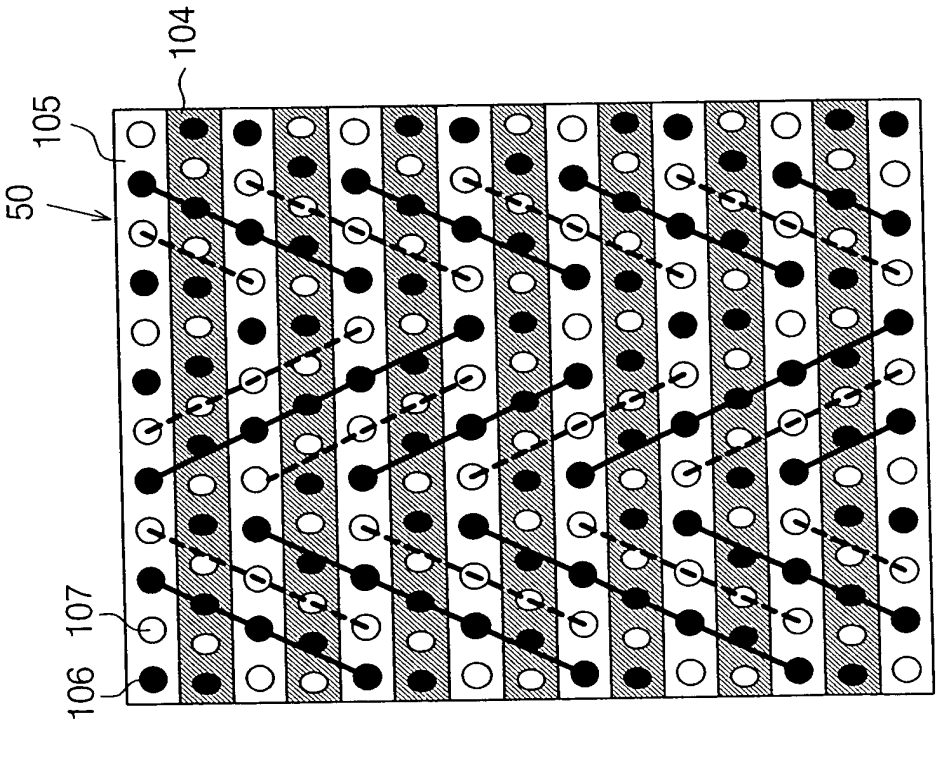


Fig.22

Fig.23

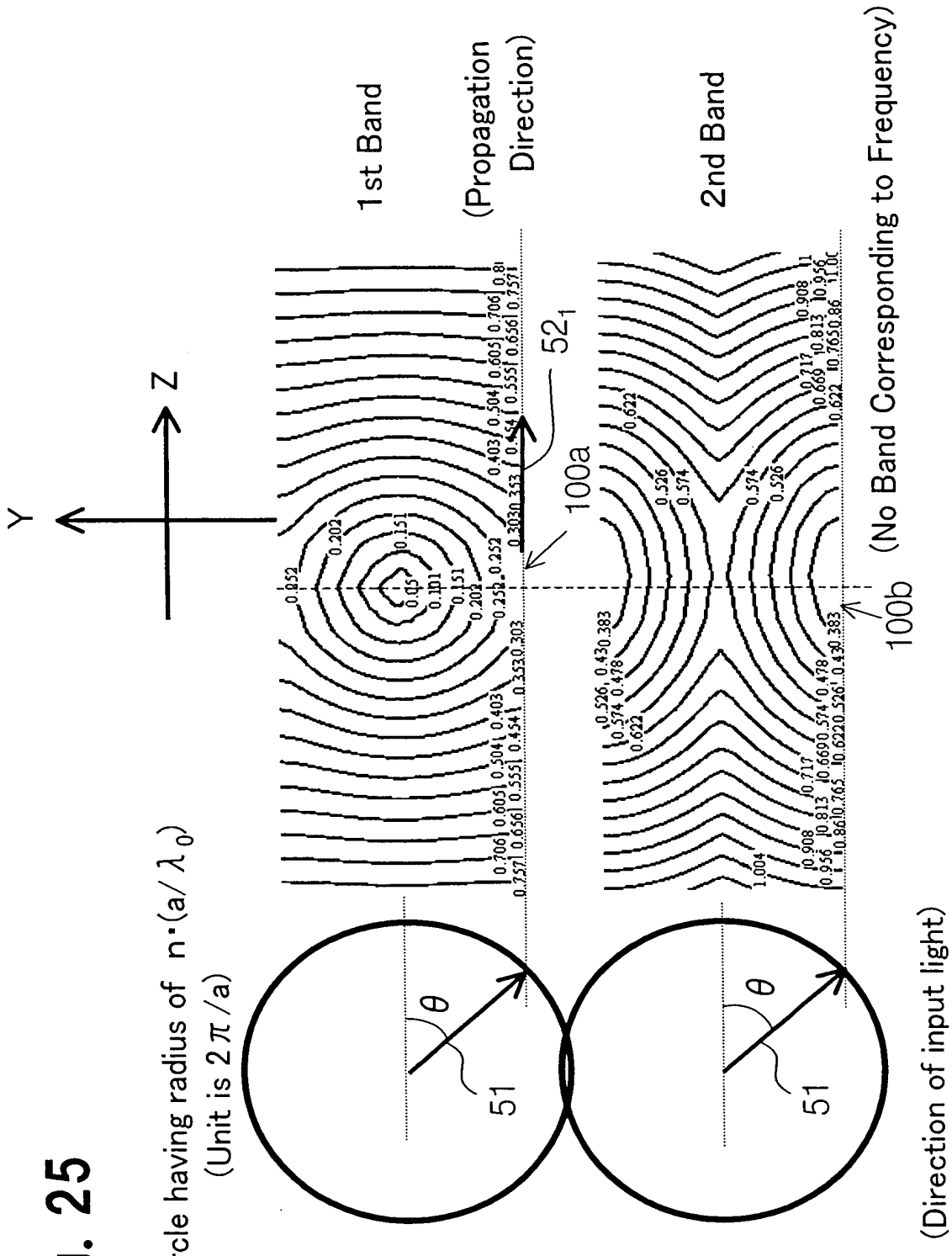

50
106 107
105
104
50
106 107
Propagation Shape Resulting from 1st Band
(Electric Field Locally Existing
In High Refraction Rate Layer)
Propagation Shape Resulting from 2nd Band
(Electric Field Locally Existing
In Low Refraction Rate Layer)



Propagation Shape Resulting from 1st and 2nd Bands

Fig.24

Fig. 25


Circle having radius of n·(a/λ0)
(Unit is 2π/a)
Y
Z
1st Band
(Propagation Direction)
2nd Band
(No Band Corresponding to Frequency)
(Direction of input light)
52₁
100a
100b
51
θ
51
θ

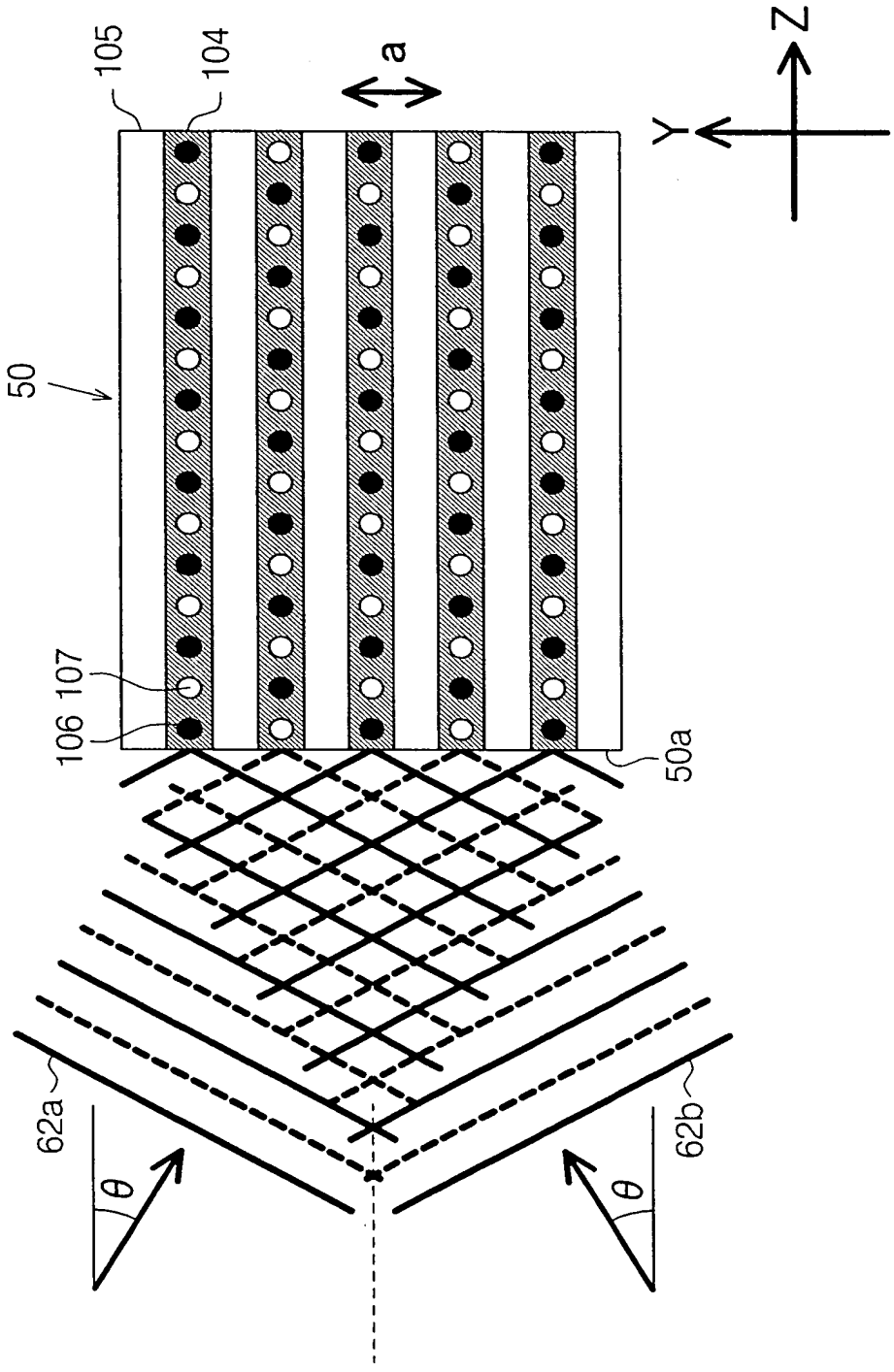


Fig.26

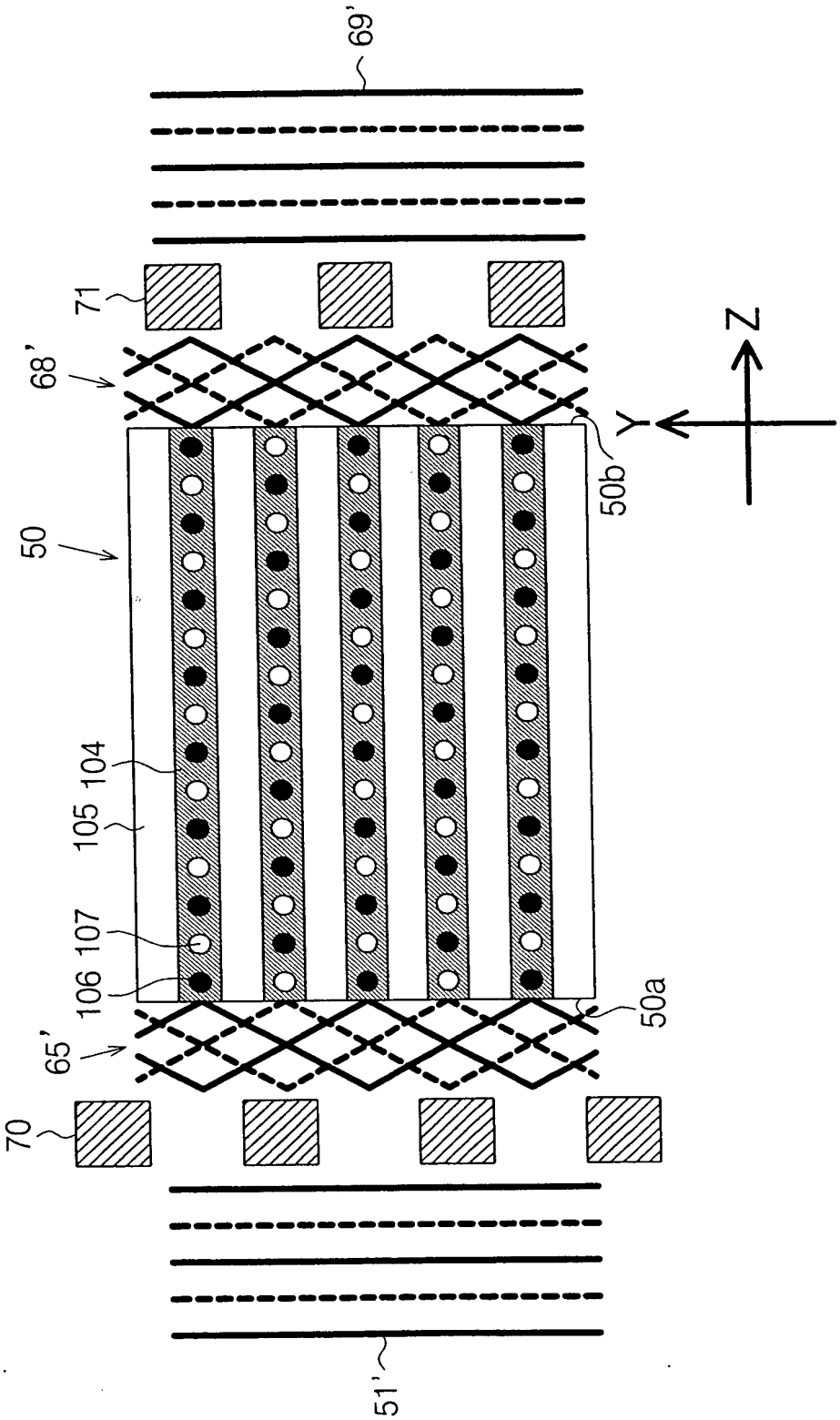


Fig.27

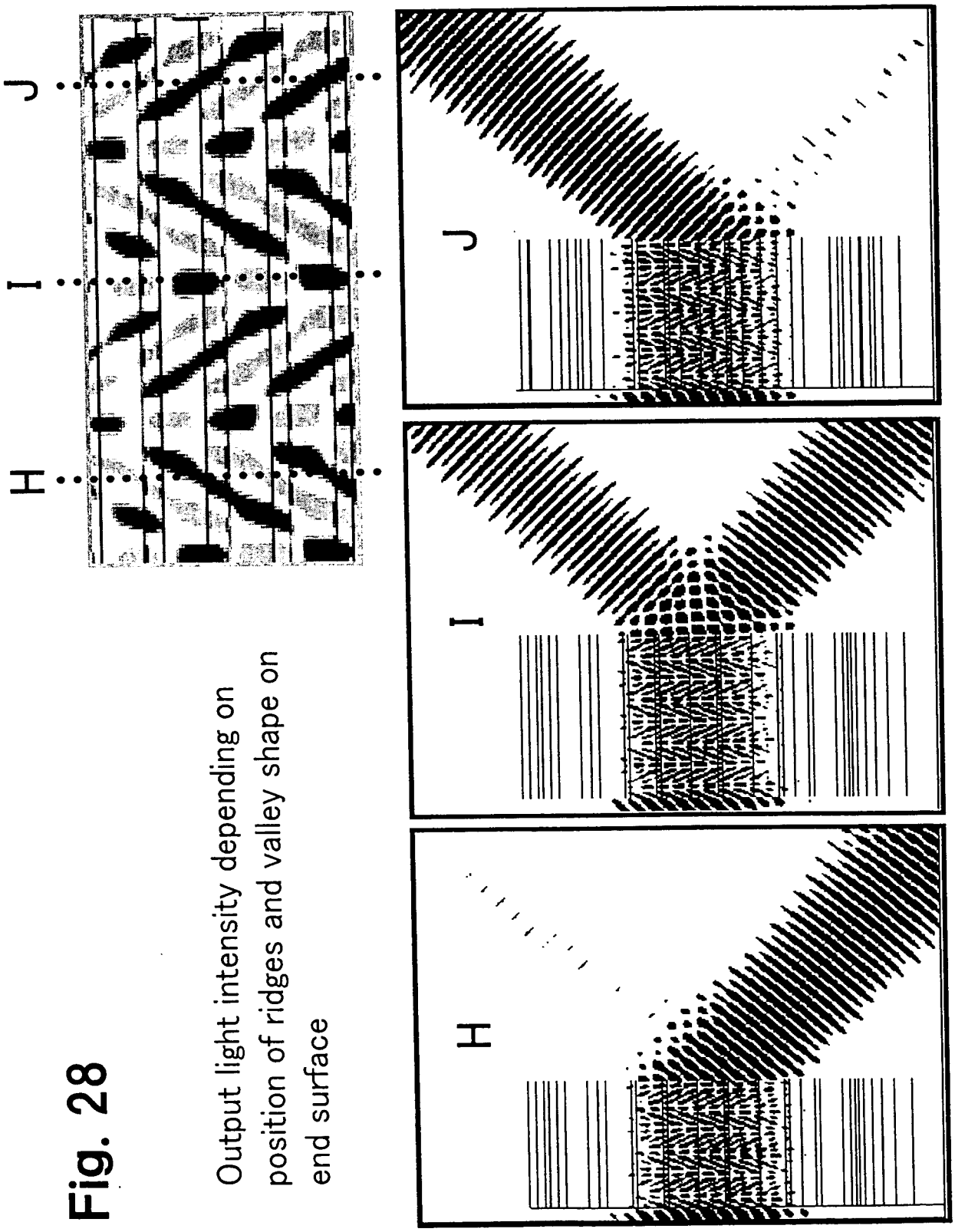


Fig. 28

Output light intensity depending on position of ridges and valley shape on end surface

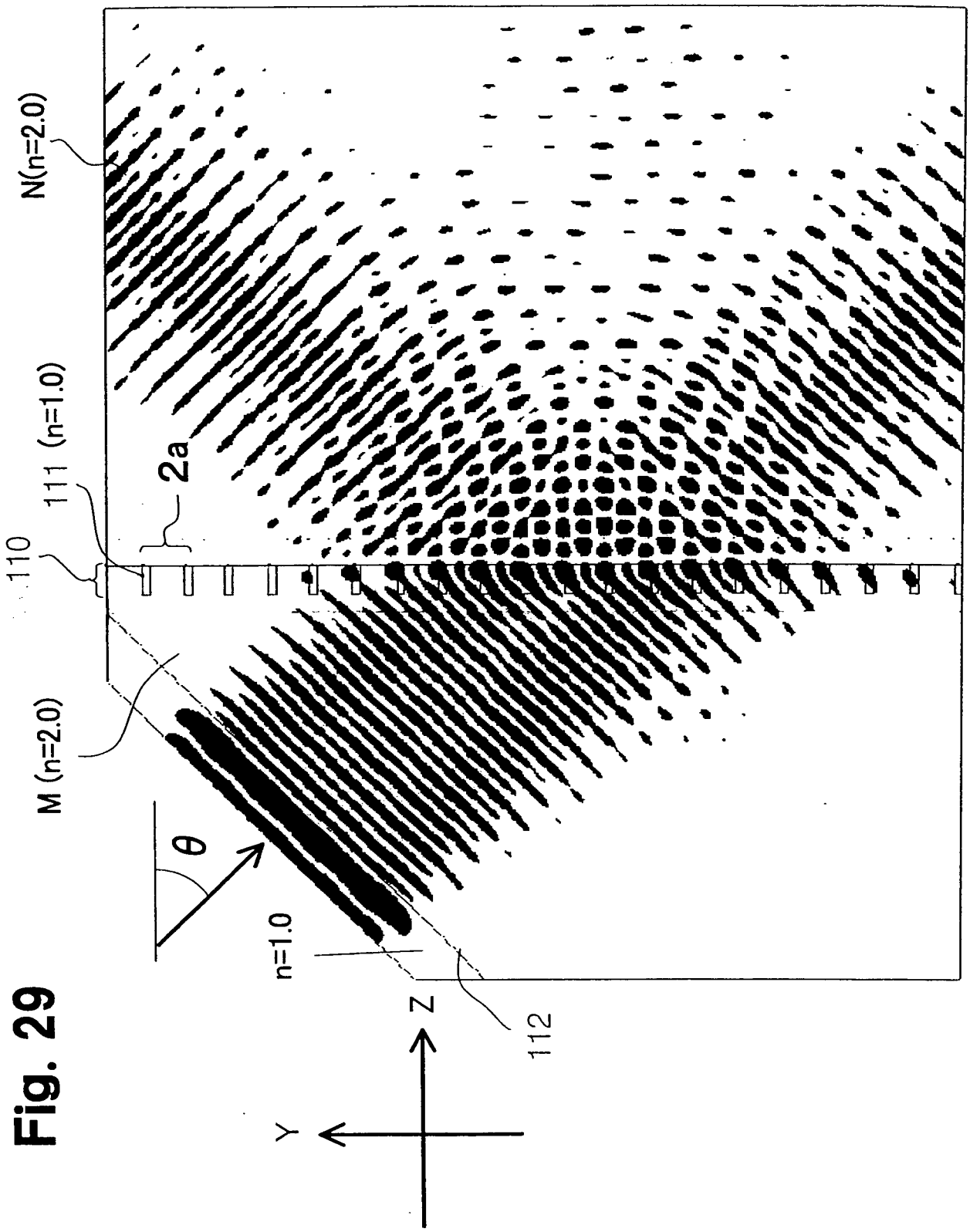


Fig. 29

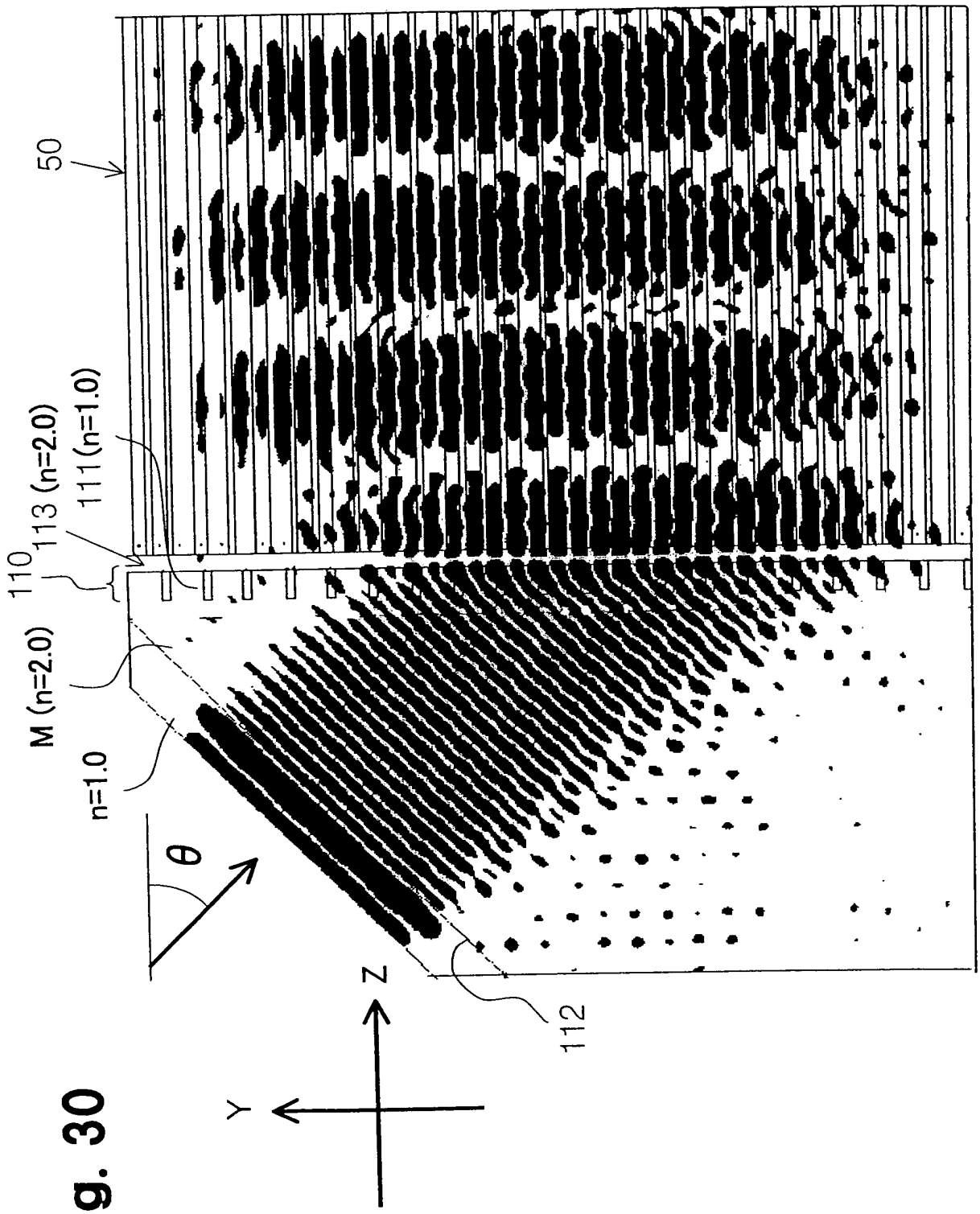


Fig. 30

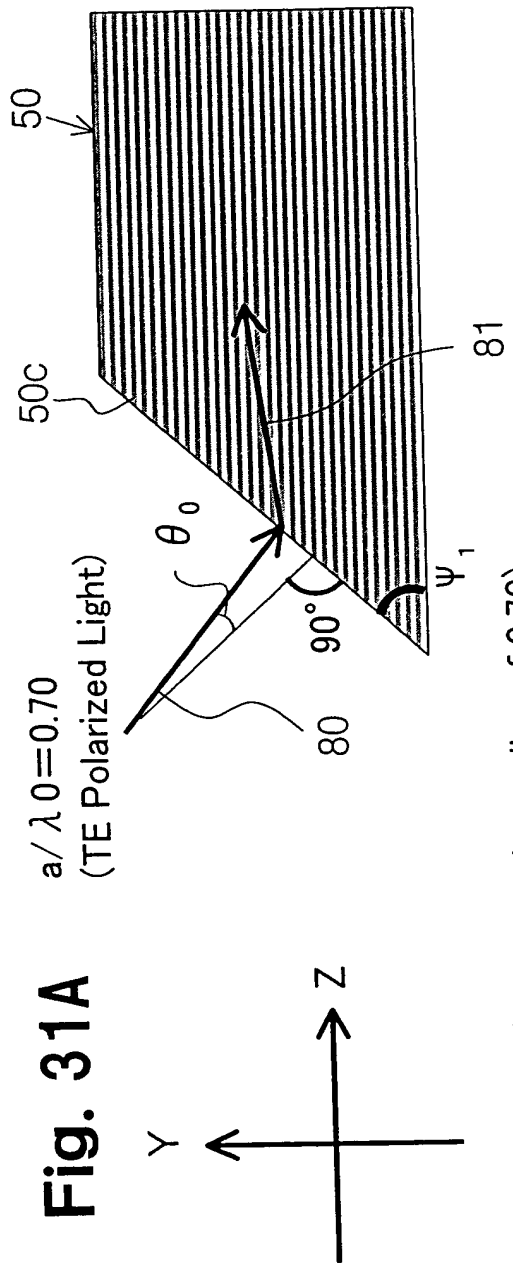


Fig. 31A

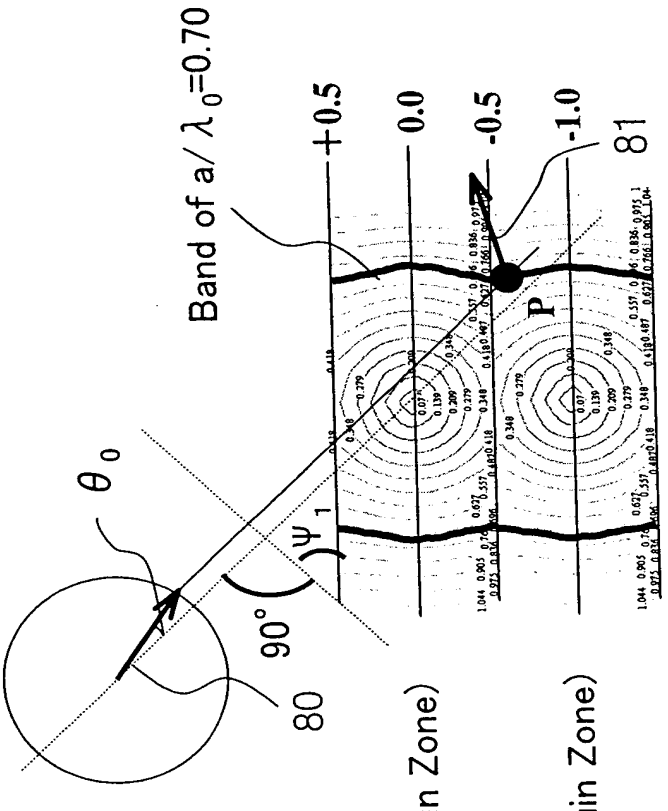


Fig. 31B

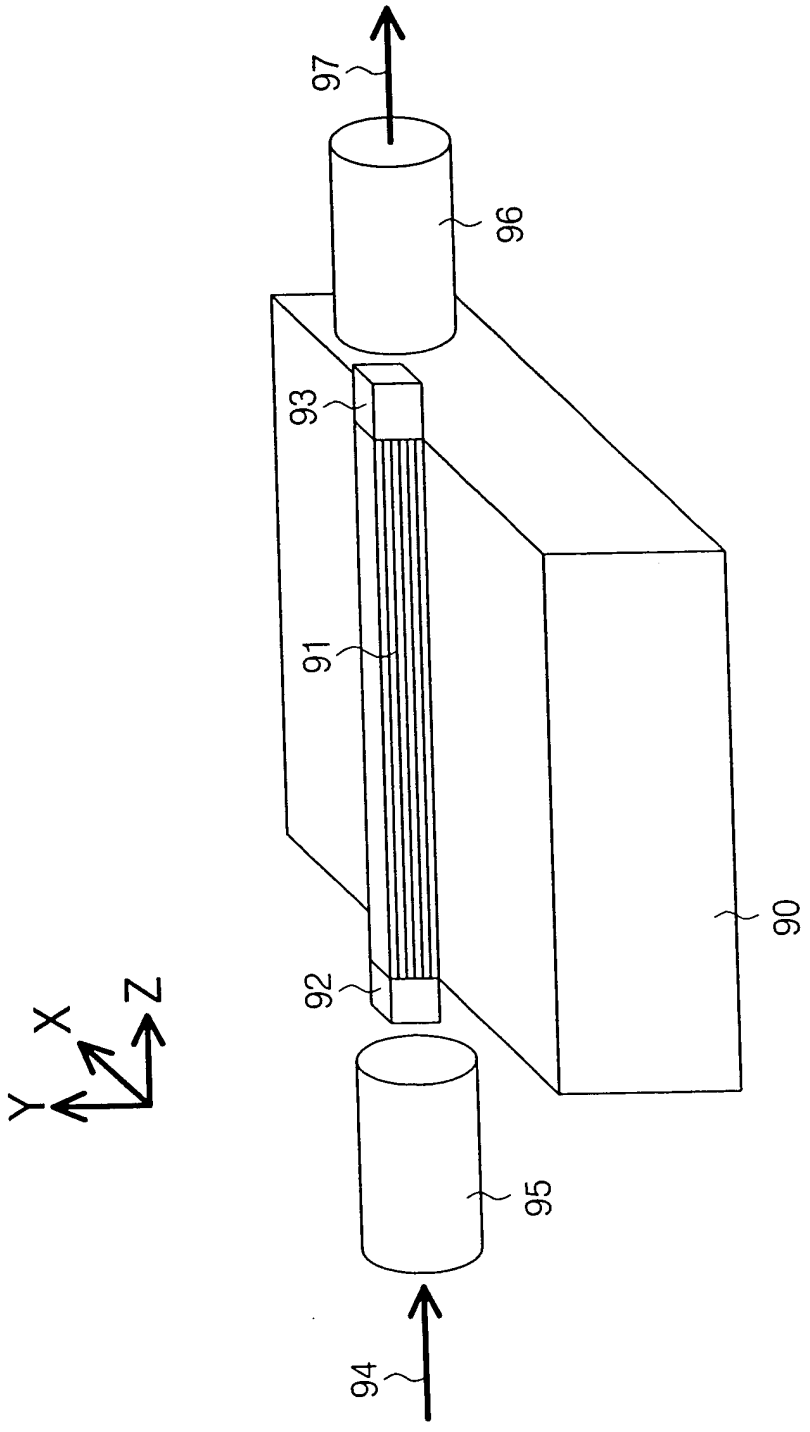


Fig.32

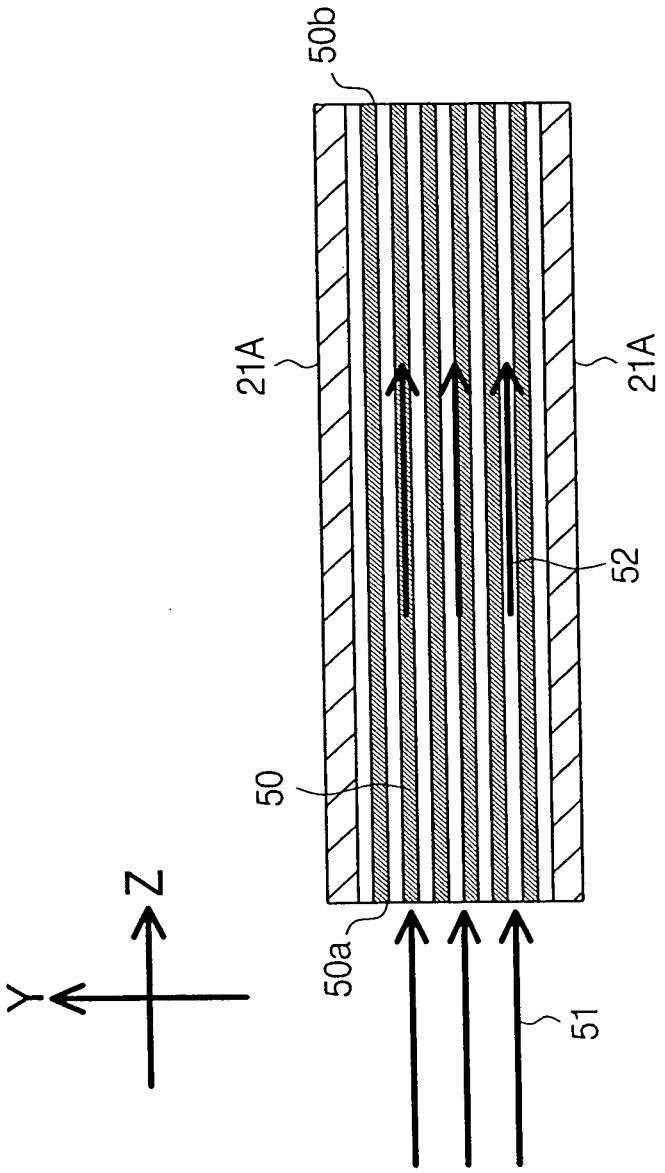


Fig.33

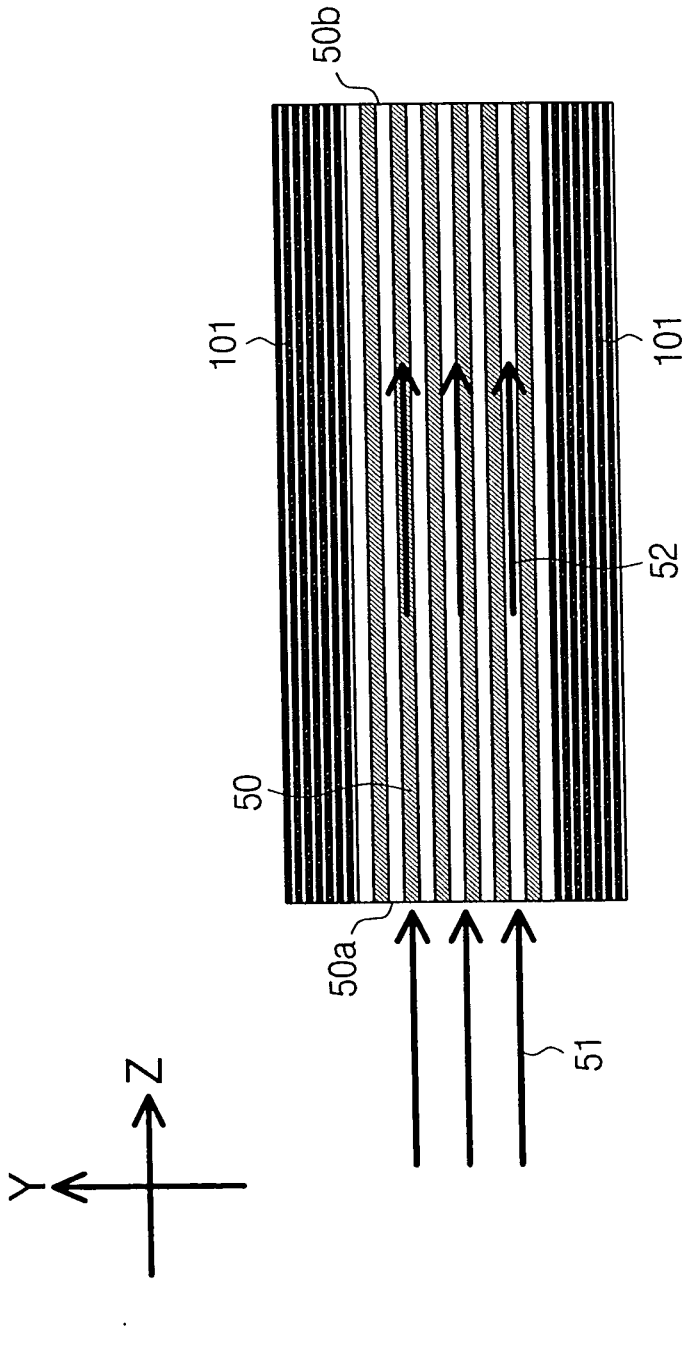
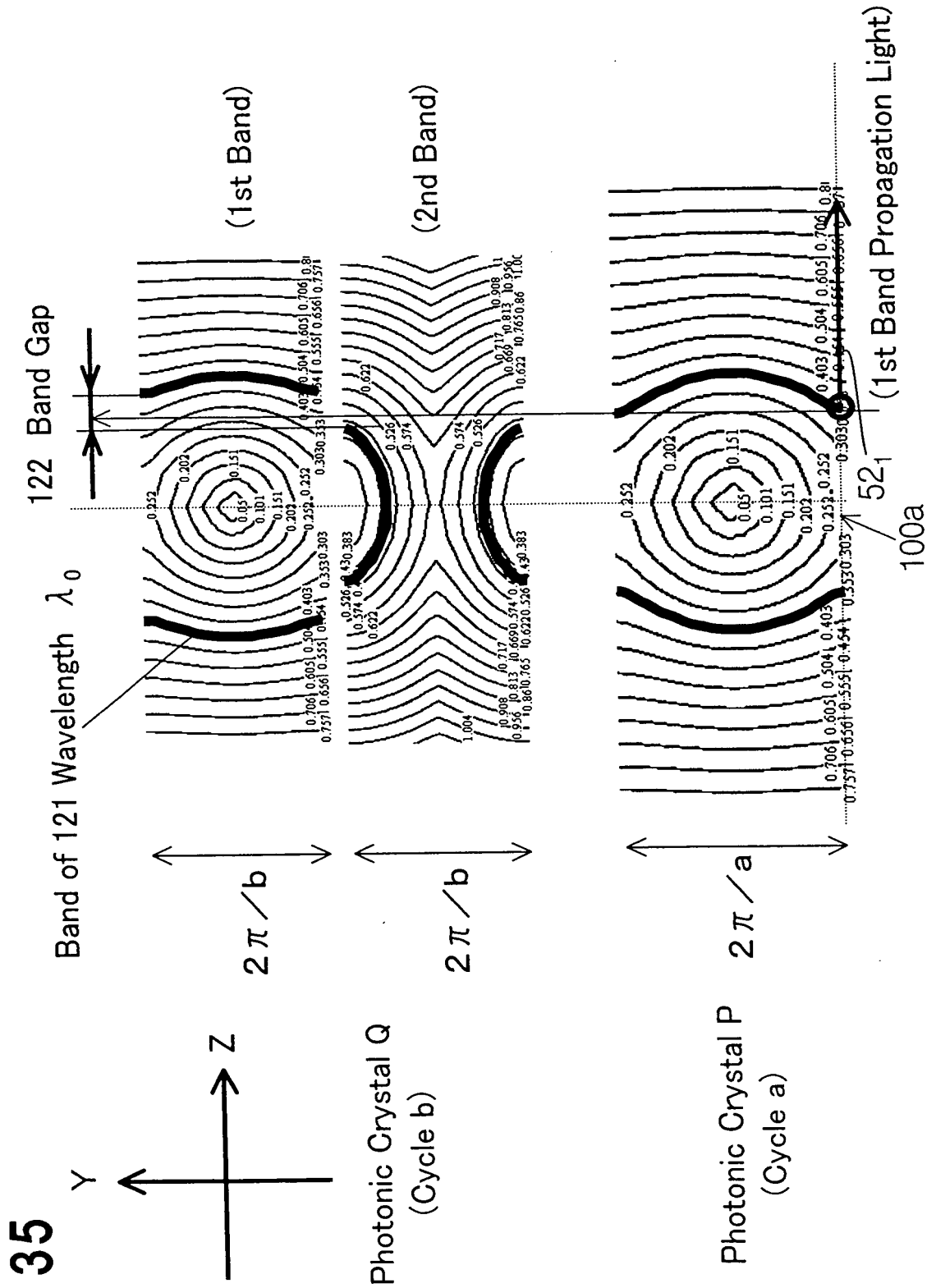


Fig.34

Fig. 35


Y
Z
Band of 121 Wavelength λ_0
122 Band Gap
(1st Band)
(2nd Band)
$2\pi/b$
$2\pi/b$
$2\pi/a$
Photonic Crystal Q
(Cycle b)
Photonic Crystal P
(Cycle a)
52_1
(1st Band Propagation Light)
100a

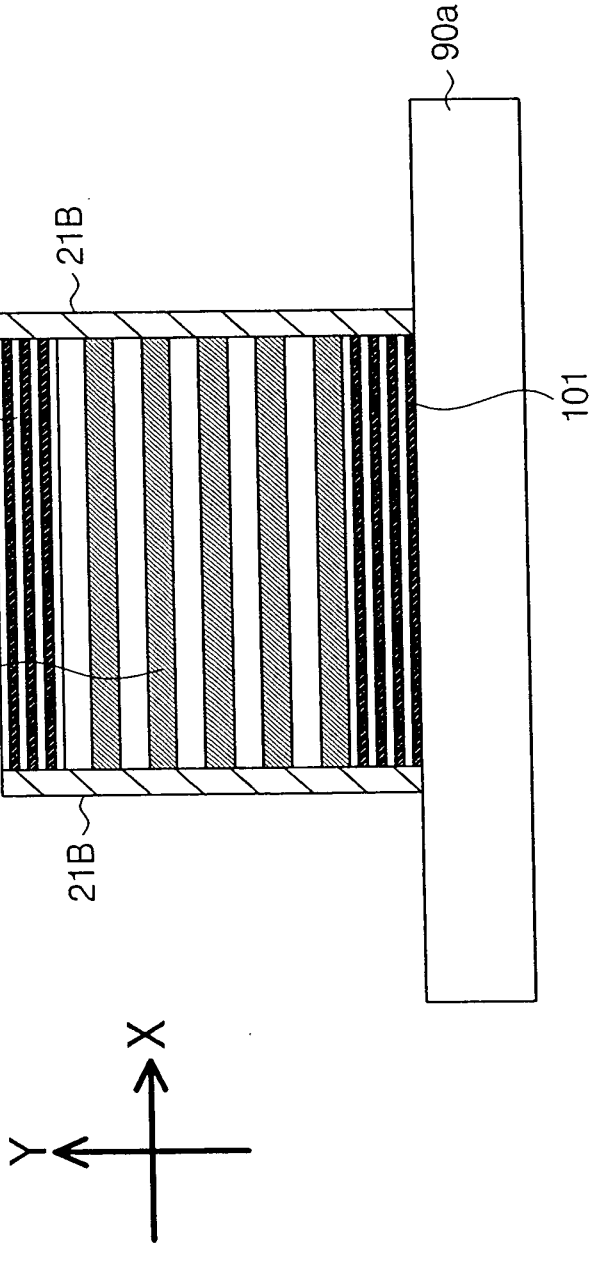


Fig.36

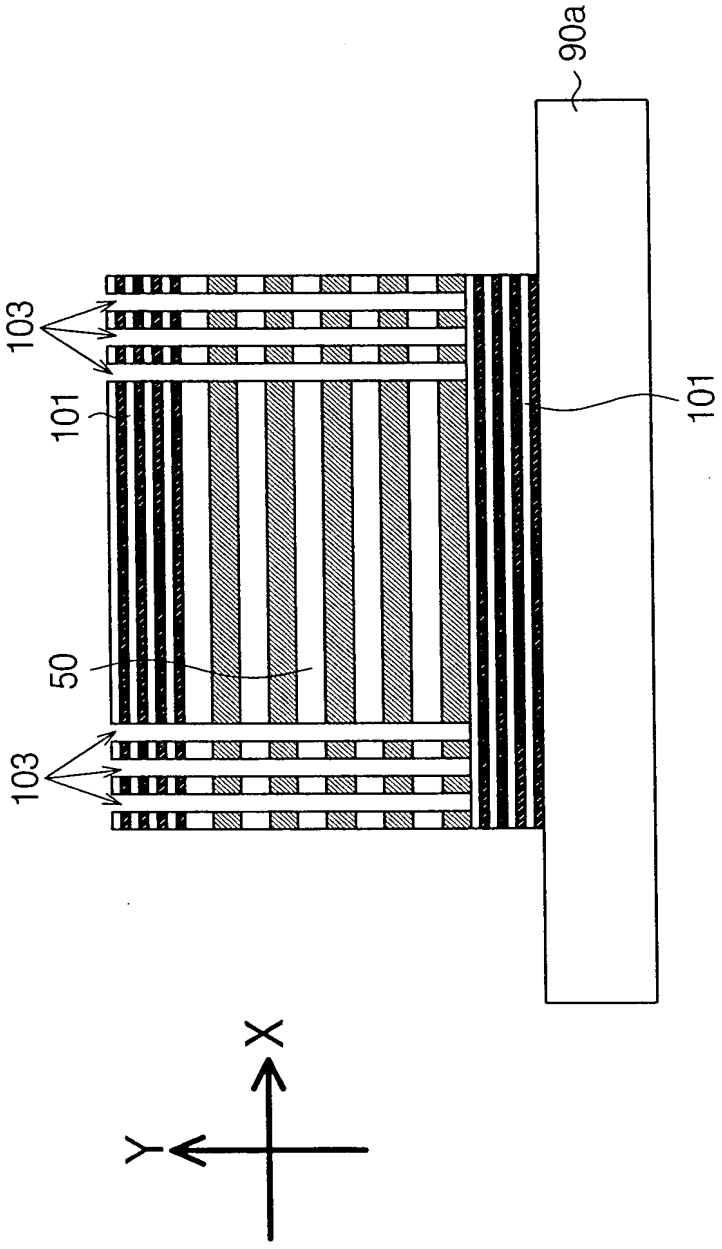


Fig.37

Fig.38

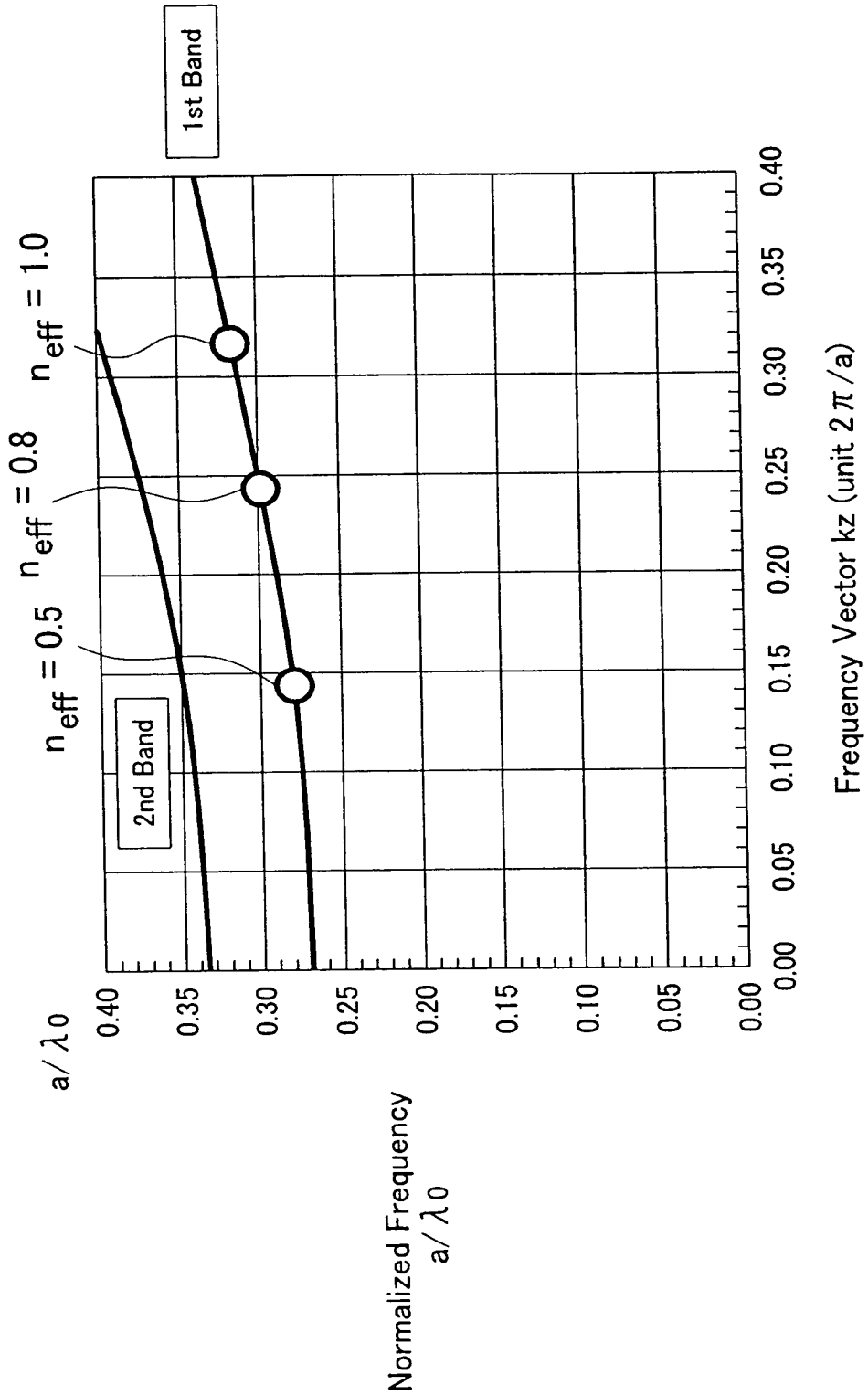

1st Band
2nd Band
n_{eff} = 0.5
n_{eff} = 0.8
n_{eff} = 1.0
a/λ0
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Normalized Frequency
a/λ0
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
Frequency Vector kz (unit 2π/a)

Fig.39

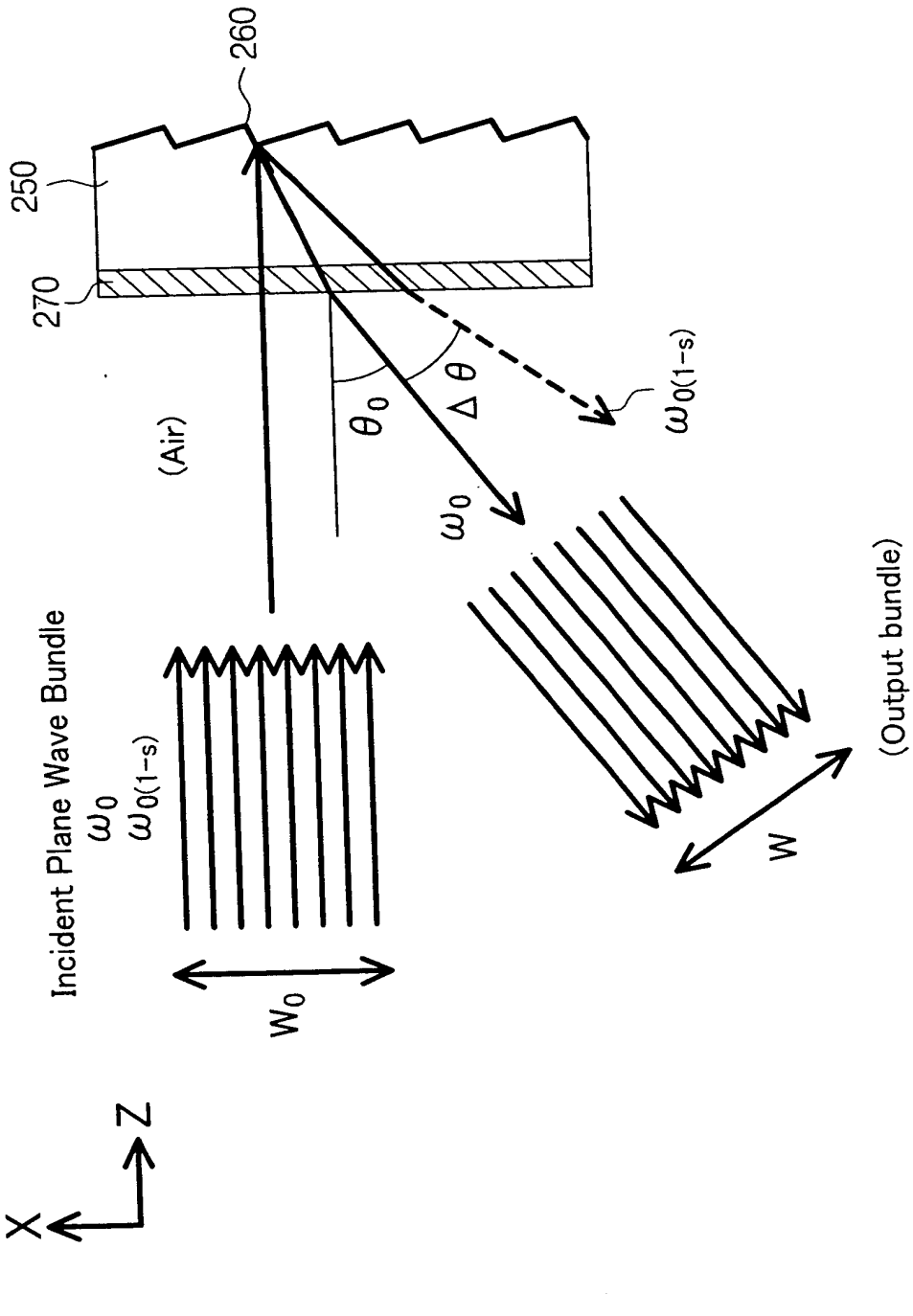
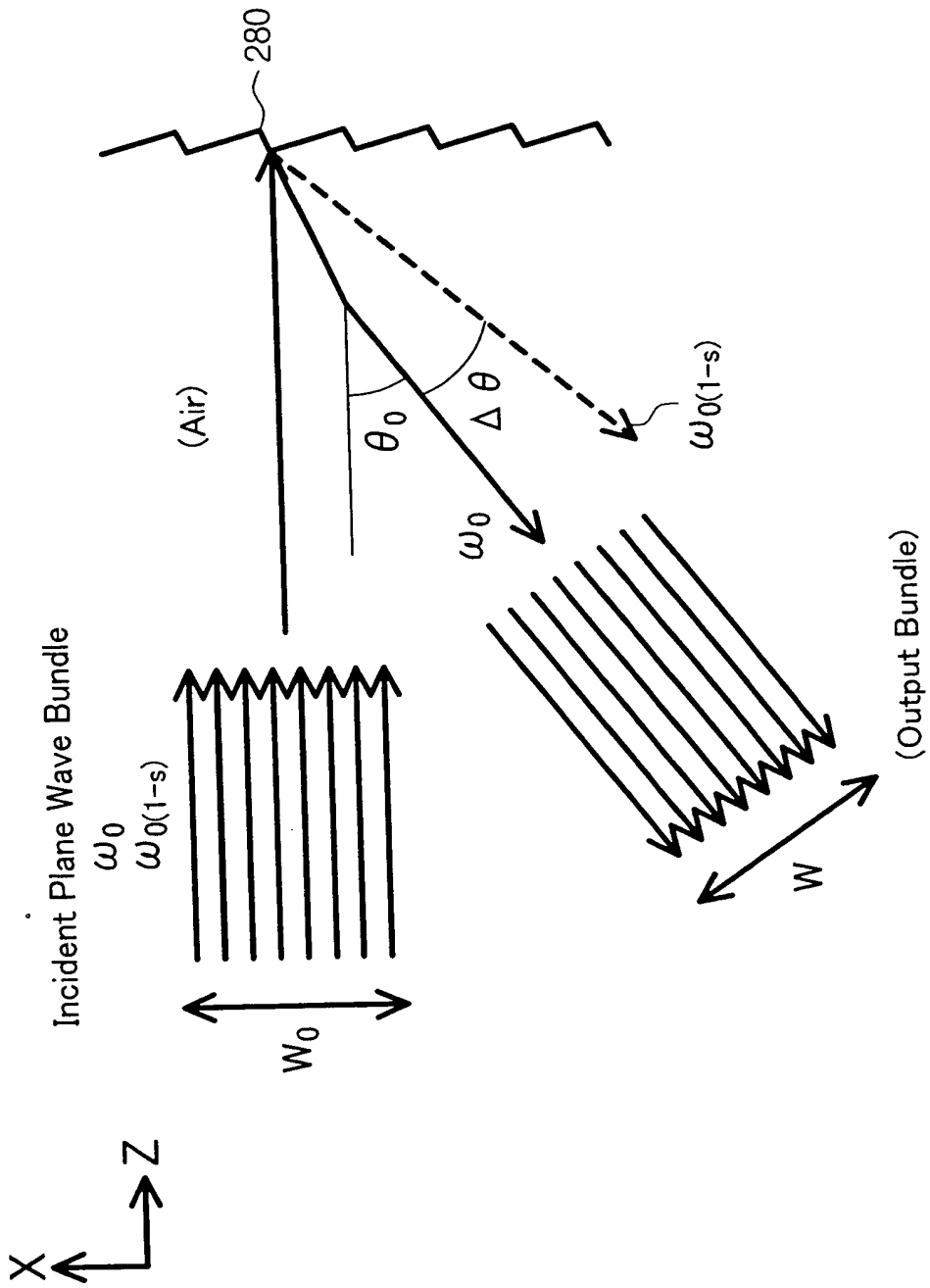

260
250
270
(Air)
θ_0
$\Delta\theta$
$\omega_{0(1-s)}$
ω_0
Incident Plane Wave Bundle
ω_0
$\omega_{0(1-s)}$
W_0
W
(Output bundle)
X
Z

Fig.40


280
(Air)
θ_0
$\Delta\theta$
$\omega_{0(1-s)}$
ω_0
Incident Plane Wave Bundle
ω_0
$\omega_{0(1-s)}$
W_0
(Output Bundle)
W
X
Z

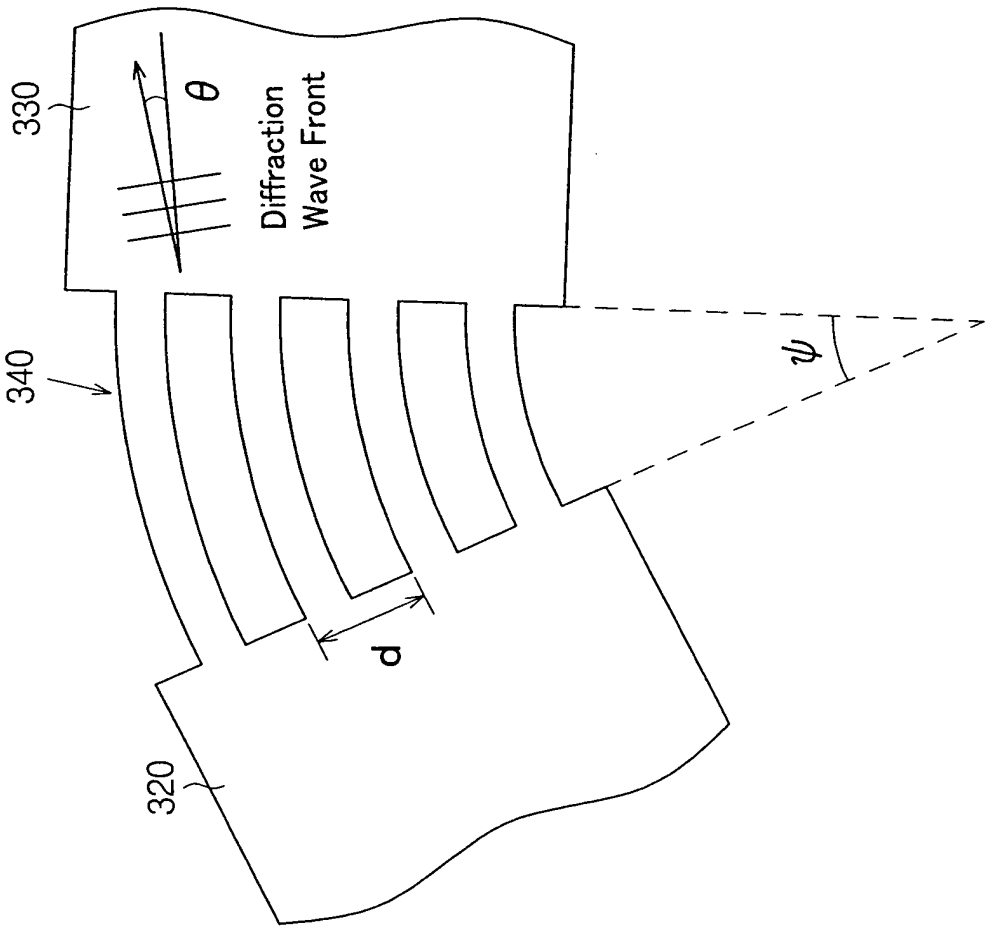


Fig.41

Fig.42A

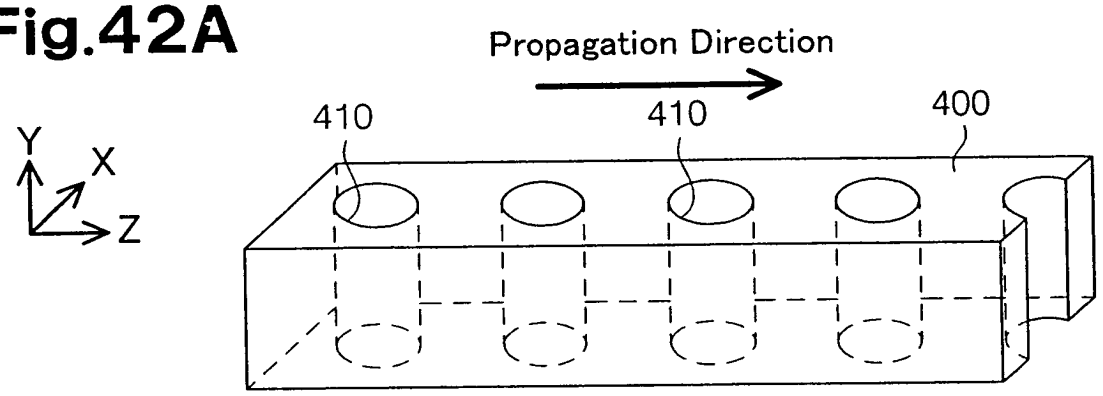


Fig.42B

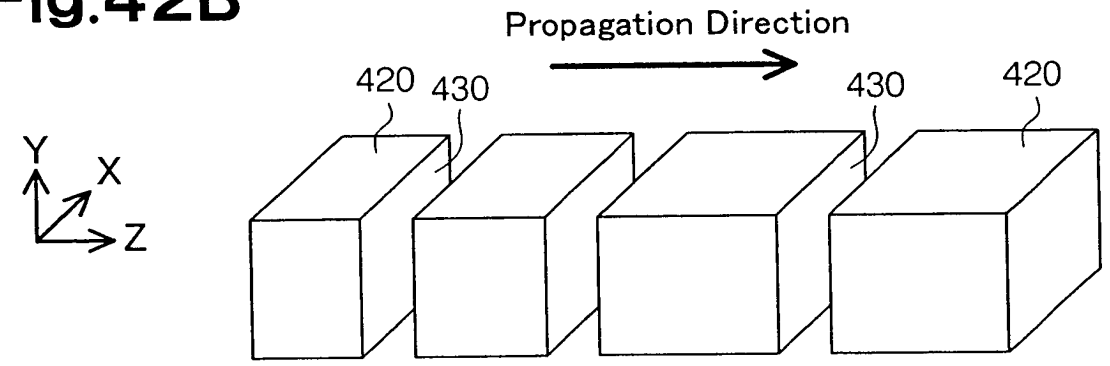


Fig.42C

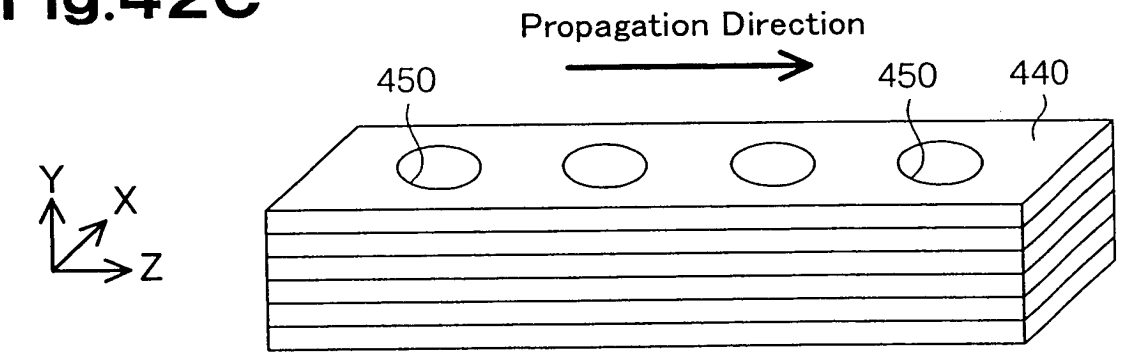


Fig.42D